Before the
Federal Communications Commission
Washington, DC

In the Matter of	)	
	)	
Section 68.4(a) of the Commission's Rules	)	WT Docket No. 01-309
Governing Hearing Aid Compatible	)	
Telephones	)	
	)	

Hearing Aid Compatibility Status Report #4

Submitted by

the Alliance for Telecommunications Industry Solutions

on behalf of the

ATIS Incubator Solutions Program #4 – Hearing Aid Compatibility

Table of Contents

I. Introduction

The Alliance for Telecommunications Industry Solutions ("ATIS"), on behalf of its Incubator Solutions Program #4 -Hearing Aid Compatibility ("AISP.4-HAC" or "Incubator"), hereby files this fourth Status Report detailing the efforts that wireless handset device manufacturers and service providers are undertaking to comply with the Federal Communications Commission's ("FCC" or "Commission") hearing aid compatibility ("HAC") requirements as defined in the Commission's *Report and Order* in WT Docket No. 01-309 ("*R&O*").[1]

This fourth Status Report filed by AISP.4-HAC represents collective inputs from Incubator members and, pursuant to the Commission's March 8, 2004, *Public Notice*,[2] is submitted in lieu of individual status reports from those members.[3] This Status Report documents the accomplishments and concerns of the Incubator and its Working Groups ("WG") as well as a listing of compliant wireless devices ("WD").[4]

As noted in previous status report filings, AISP.4-HAC has engaged in efforts to correct and complete the ANSI C63.19 Standard. The Incubator's recommendations and concerns with regard to the C63.19 Standard are defined in the AISP.4-HAC Hearing Aid Compatibility Test Specification ("HACTS") document, which addresses the FCC's HAC requirements. [5]

Through the ongoing efforts of AISP.4-HAC, the wireless industry has had success in complying with the Commission's HAC rules. As of November 1, 2005, the wireless industry has more than sixty (60) models with FCC- granted M3 or M4 ratings on the market. Both the hearing aid and wireless industries have made great strides towards making digital cellular wireless devices and hearing aids compatible.

Comprehensive educational activities of AISP.4-HAC continue to ensure a far-reaching, consistent message to hard of hearing consumers looking to purchase WDs compatible with hearing aids. In recognition of its efforts, AISP.4-HAC was honored in July 2005

[1] In the Matter of Section 68.4(a) of the Commission's Rules Governing Hearing Aid Compatible Telephones, *Report and Order*, WT Docket No. 01-309 (rel. Aug. 14, 2003); *Errata*, WT Docket No. 01-309, (rel. Aug. 27, 2004).

[2] *Public Notice*, WT Docket No. 01-309, DA 04-630 (rel. Mar. 8, 2004).

[3] The members of AISP.4-HAC are listed in Section II A of this document. Some members may file supplemental reports to provide additional company-related information. *See* In the Matter of Section 68.4(a) of the Commission's Rules Governing Hearing Aid Compatible Telephones, *Memorandum Opinion and Order*, WT Docket No. 01-309 (rel. Sept. 8, 2005) at ¶2.

[4] As used in this report, WD is an acronym that encompasses all wireless devices such as cellular telephones, handsets, and personal digital assistants.

[5] The Commission's *R&O* cites C63.19 (2001), published October 8, 2001, as the standard to employ to determine the compatibility of hearing aids and wireless devices. However, the Commission issued a *Public Notice*, DA 05-113-1 (rel. April 25, 2005), clarifying that applicants may use either the 2001 or 2005 version of the C63.19 Standard.

with the National Wireless Access Award for 2005 from Self Help for Hard of Hearing People ("SHHH") for AISP.4-HAC's consumer outreach efforts.

However, significant challenges remain. Many of these challenges stem from the fact that the Incubator and its members must confront two issues: (1) the need to clarify, revise and, in some cases, modify the C63.19 Standard in order to ensure testing is accurate, repeatable and results in consistent and meaningful measures for consumers; and (2) the challenges stemming from having to develop products and services, in a very short timeframe, to comply with an evolving standard.

In efforts to achieve the September 18, 2006 deadline for magnetic ("T-coil") compatibility, AISP.4-HAC is applying a similar technical review and methodology through the Incubator that was used to evaluate and meet the RF emission requirements of the C63.19 Standard. Thus far, the Incubator has focused on lab procedures and the language of C63.19 to ensure that the Standard is accurately interpreted and, most importantly, that testing completed under the Standard is repeatable.

Manufacturers have begun to measure their wireless devices for T-coil compatibility as currently defined in the Standard. The Incubator will establish another separate Working Group to collect the manufacturers' inputs and oversee the correlation of test data. It is anticipated that similar issues to those that were identified in the RF emissions procedure may arise with the interpretation of the C63.19 Standard's measurement and testing set ups for T-coil compatibility. AISP.4-HAC is committed to recommending updates to the Standard, to eliminate any possible discrepancies or misinterpretations and to reflect agreements and recommendations based on its testing that will allow the C63.19 Standard to be ubiquitously implemented.

II. Background

A. General Overview of AISP.4-HAC

ATIS is a technical planning and standards development organization accredited by ANSI and committed to rapidly developing and promoting technical and operational standards for communications and related information technologies worldwide using a pragmatic, flexible and open approach. Industry professionals from more than 350 communications companies actively participate in ATIS' open industry committees, fora and "Incubators." The ATIS membership spans all segments of the industry, including local exchange carriers, inter-exchange carriers, wireless equipment manufacturers, competitive local exchange carriers, data local exchange carriers, wireless providers, providers of commercial mobile radio services, broadband providers, software developers and internet service providers.

The ATIS Incubator Solutions Program is a flexible, streamlined "fast track" process in which a company or organization can advance a technical or operational telecommunications issue in an environment designed to develop solutions. In this alternative approach toward solutions development, a company or organization can expeditiously introduce pressing issues and focus on market driven needs and results.

AISP.4-HAC is focused on the technical issues addressing interoperability and compatibility of wireless devices with hearing aids, including the evaluation and test methodology of the measurement standard as referenced in the C63.19 Standard. AISP.4-HAC is composed of technical experts from the wireless industry representing wireless manufacturers and service providers, as well as technical experts representing the hearing aid industry. Representatives from consumer advocacy and disability groups also actively participate in AISP.4-HAC meetings.

The Incubator's mission is to investigate and identify interference issues affecting the performance of hearing aids and wireless devices and to determine methods of enhancing interoperability and usability of wireless devices by consumers with hearing aids. Through an open and impartial consensus process, AISP.4-HAC is investigating and developing recommendations to the C63.19 Standard for measuring hearing aid immunity, magnetic coupling and interference that may occur between wireless devices and hearing aids, including the evaluation and test methodology referenced in the C63.19 Standard.

The AISP.4-HAC has the following membership as of November 17, 2005:

VOTING MEMBERS

American Cellular Corporation
Alltel
Brookings Municipal Utilities d/b/a Swiftel Communications
Carolina West Wireless
Cingular Wireless LLC
Corr Wireless Communications, LLC
Cricket Communications
Dobson Cellular Systems, Inc.
Epic Touch
Hearing Industries Association
Immix Wireless
Key Communications
Keystone Wireless
Kyocera Wireless
Leap Wireless
LG Electronics, Inc.
Louisiana Unwired
Motorola, Inc.
NEC America, Inc.
Nextel Partners Inc.
Nokia
Qwest Wireless
Research In Motion Limited
Samsung Telecommunications America LP
Sprint-Nextel
Sony Ericsson Mobile Communications (USA), Inc.
Suncom
T-Mobile USA
UTSTARCOM
Verizon Wireless

WORKING PARTICIPANTS

Alexander Graham Bell Association for the Deaf and Hard of Hearing
American Academy of Audiology
American Academy of Dispensing Audiology
American Speech-Language-Hearing Association
ANSI ASC C63
APREL Labs
CTIA-The Wireless Association®
ETS-Lindgren
Gallaudet University – Technology Access Program and Rehabilitation Engineering Research Center
Information Technology Technical Assistance and Training Center (ITTATC)
PC Test Engineering Laboratory, Inc.
Schmid & Partner Engineering AG (SPEAG)
Self Help for Hard of Hearing People (SHHH)

B. FCC HAC Regulations

On August 14, 2003, the FCC released its HAC *R&O*, which modified the exemption for wireless phones under the Hearing Aid Compatibility Act of 1988[6] to require digital wireless phones to be capable of being used effectively with hearing aids. In modifying the exemption, the FCC explicitly found that it was technically feasible for digital wireless phones to comply with the requirement of the established HAC technical standard -- the C63.19 Standard. According to the FCC, the C63.19 Standard (C63.19 (2001)) is "a detailed standard that is highly predictive of the usability of compatible wireless phones with sufficiently immune hearing aids…"[7]

The work of the ATIS Incubator began even before the release of the text of the *R&O*. On July 31, 2003, ATIS convened a Steering Committee to begin its evaluation of the C63.19 Standard in order to determine methods of enhancing interoperability and usability for consumers with hearing aids. From the beginning, the Incubator identified issues with regard to testing and performance under the C63.19 Standard and worked closely with ASC C63, representatives from the hearing aid industry and the FCC to address these issues. The Incubator's technical work focused on three main actions: (1) developing testing and measurement methodologies for WDs under the C63.19 Standard; (2) identifying uncertainties and other technical issues with the C63.19 Standard and working with ASC C63 to address these issues; and (3) educating the FCC on issues that may affect compliance by carriers and manufacturers related to the C63.19 Standard.

The input from the Incubator was considered by the FCC in making important changes to its HAC rules. On April 25, 2005, the FCC released a *Public Notice* to clarify use of the

[6] Section 710 of the Communications Act of 1934, as amended, 47 USC § 710(b)(1)(B).
[7] *R&O* at ¶43.

2005 version of the C3.19 Standard.[8] Applicants for certification may rely on either the 2001 or 2005 version of the C63.19 Standard and must identify which version they are using for compatibility testing and for rating wireless phones.

On June 21, 2005, the FCC released an *Order on Reconsideration* (*OR*) and *Further Notice of Proposed Rulemaking* to address changes to the HAC rules. Among the changes made to the rules was revision to the labeling requirements for HAC WDs that was recommended by the Incubator.[9] In addition the FCC revised the U3 requirements, but did not modify the U3T requirements, specifying the number of models per air interface each manufacturer and carrier were required to offer. Under the revised rules, carriers and manufacturers were required to use the "M" and "T" ratings found in the 2005 version of the Standard to avoid consumer confusion with the existing labeling scheme for hearing aids. The *OR* also revised the requirement regarding the handset deployment benchmark for HAC WDs, providing that Tier 1 carriers must provide four (4) U3-rated models per air interface or 25% of the total number of carriers that it offers nationwide by September 16, 2005, and five (5) U3-rated models per air interface or 25% of the total number of carriers that it offers nationwide by September 16, 2006.

Unlike the FCC's requirements for radiofrequency interference (measured by the U3 rating), the telecoil compatibility requirements do not differ for Tier I and smaller carriers; both must offer two telecoil compliant handsets per air interface.

As the Incubator began its HAC technical work, manufacturers raised certain issues with the testing of HAC WDs under the C63.19 Standard. These issues, explained more in Section IV of this report, were not anticipated in the C63.19 Standard when this standard was released by ANSI or adopted by the Commission. At the time of adoption in 2003, testing procedures in the Standard had not yet been validated to determine whether existing handsets could meet the standard. It was also determined that the initial testing that had occurred yielded inconsistent results.

One of these issues pertained to GSM WDs operating in the 850 MHz band. This issue stemmed in part from the fact that the 2001 version of the C63.19 Standard preceded the wireless industry's launch and handset rollout of GSM 850 MHz WDs. The initial testing of the C63.19 Standard in 2001 did not include wireless devices tested at 2 watts in the 850 MHz band. Testing by the Incubator and its members validated the proposed frequency band differentiation, noted by the University of Oklahoma, between the 1900 MHz and 850 MHz bands.

On September 8, 2005, the FCC once again responded to technical concerns raised by the Incubator. In its *Memorandum Opinion and Order*, the FCC acknowledged the

[8] *Public Notice*, WT Docket No. 01-309, DA 05-1134 (re. April 25, 2005). C63.19-2005 remains under development and continues to be revised to address industry testing and measurement concerns. As of November 7, 2005, the current draft of C63.19 (2005) was denoted as revision draft (rd) 3.10.

[9] In the Matter of Section 68.4(a) of the Commission's Rules Governing Hearing Aid Compatible Telephones, *Order on Reconsideration and Further Notice of Proposed Rulemaking*, WT Docket No. 01-309 (rel. June 21, 2005).

difficulties that were identified by ATIS with the HAC rating of 850 MHz GSM WDs under the C63.19 Standard.[10] The FCC agreed to temporarily accept, under waiver, the hearing aid compatibility compliance rating for dual-band GSM WDs based on their measurement rating from the 1900 MHz band only.[11]

C63.19-2005 is currently being re-balloted. The Standard now represents the correct band differentiation between 850 MHz and 1900 MHz. However, if the Standard is not accepted by the balloting group within C63.19, the manufacturers of dual band higher power products operating in 850/1900 MHz will not be capable of meeting the FCC mandates for RF emissions.

The Incubator continues to work to address technical issues regarding HAC of digital wireless devices. ATIS appreciates the actions taken by the FCC to date, to address the concerns identified by the Incubator and its members, and will continue to work to identify technical issues and make recommendations for solutions to further deploy HAC WDs.

III. Consolidated HAC Compliance Report

Table 1- Consolidated Status Report on Hearing Aid Compatibility

Consolidated Status Report on Hearing Aid Compatibility	*Quantity*
Wireless Industry Companies Participating in AISP.4-HAC:	**29**
Wireless Service Providers :	**21**
Wireless Device Manufacturers:	**8**
As Reported in Individual Status Report Forms by 11 Service Providers	**-**
CDMA compliant models	**38**
GSM compliant models	**24**
*i*DEN compliant models	**12**
*TDMA compliant models	**0**
Multiple Air Interface	**0**
Total HAC Compliant WD Models offered by Service Providers:	**74**
Total WD models offered by Service Providers:	**217**
As Reported in Individual Status Report Forms by 7 Manufacturers	-
CDMA compliant models	**37**
GSM compliant models	**21**
*i*DEN compliant models	**8**
*TDMA compliant models	**0**
Multiple Air Interface	**1**
Total HAC Compliant WD Models offered by Manufacturers:	**67**
Total WD models offered by Manufacturers:	**216**

**Note: The TDMA air interface is undergoing an industry-wide phase out and replacement by GSM. TDMA carriers received a blanket waiver in the June 2005 Order on Reconsideration.*

[10] In the Matter of Section 68.4(a) if the Commission's Rules Governing Hearing Aid Compatible Telephones, *Memorandum Opinion and Order* (MO&O), WT Docket No. 01-309 (rel. September 8, 2005).
[11] *MO&O* at ¶8. The FCC agreed to accept the 1900 MHz rating for dual band GSM WDs until August 1, 2006.

AISP.4-HAC has prepared a compliance status report form for use by its members. The "Status Report on Hearing Aid Compatibility" is appended hereto as **Attachment A**. Completed compliance reports from individual AISP.4-HAC members are included as **Attachment A1**.

IV. HAC Compliance/ C63.19 Standard

While working toward the achievement of consistent and accurate test data, the Incubator discovered the C63.19 Standard is not always an accurate indicator of consumer usability between hearing aids and WDs. The Incubator has sought to address these concerns and recommended solutions through active participant in the ASC C63 and its subgroups through the ANSI process. Through participation in ASC C63, the Incubator has positively affected change in the currently balloted 2005 version of the Standard as discussed in Subsection A below.

However several areas of concern remain, including, most notably, the testing methodology for T-coil requirements that may affect the wireless industries' success in meeting the Commission's T-Coil HAC compliance date of September 18, 2006. As noted in Section B below, other changes are also under consideration, including an objective method for determining an Articulation Weighting Factor (AWF) for new or future air interfaces such as LTE, WiFi and 3G technologies (UMTS).

A. Summary of Changes Submitted to the Standard

Two major recommendations for C63.19 (2005), rd 3.8, were submitted by the HAC Incubator and one is currently included in rd 3.10. The included change addresses the required frequency band differentiations for 850 MHz and 1900 MHz bands. The other change clarified the power level used during RF emissions testing.

1) Power Levels. The C63.19 Standard specifies *peak power* as the level to be used during RF emissions testing. The Incubator has demonstrated that the use of the *peak average power* during the transmit interval is more accurate because power fluctuations contained in peak power do not degrade a hearing aid (HA) wearer's hearing perception. The result of this change to the Standard is more choices of HAC WDs available for consumers. If this change is not accepted and implemented, there will be fewer HAC models of phones available to consumers.

2) Frequency Banding for Emission Levels. Hearing aids and their components are less susceptible to interference at lower frequencies. Evidence of this was indicated in testing performed by the Incubator and Cingular Wireless, and was collaborated by scientific studies conducted by DELTA Labs and TEM Consulting. It is also reflected in the European International Electrotechnical Commission (IEC) Standard and Australian HA Immunity Standard. This change will more accurately reflect users' HAC experiences with WDs

operating below 1900 MHz. This is a critical change submitted to the C63 Committee for acceptance. Without this change manufacturers will not be capable of meeting the specified RF emission limits for GSM 850 MHz wireless devices.

B. Anticipated Additional Work

Additional changes to the standard that may assist in achieving consistent and accurate test data are also under consideration.

1) T-Coil Audio Band Magnetic (ABM) Procedure. The early data from the T-coil round robin testing shows the axial and radial test results are consistent using the Telephone Magnetic field Simulator (TMFS), a device made to replicate the landline T-coil magnetic field. However, the levels obtained using the simulator are not consistent with the requirements in the C63.19 Standard. Therefore, some additional concerns may be raised during the review process.[12] More details are in Section V. of this report under the summary of WG-4's efforts.

2) AWF. The Incubator has been exploring ways to objectively determine an AWF for new technologies. While pursuing this objective, the WG-8 discovered a better method for performing HAC testing that could eliminate the need for AWF and probe modulation factors. The Incubator's work is based on the CISPR[13] standards. As explained more fully in the summary of WG-8's work, in order to effectively implement the Incubator's proposed change, two issues must be addressed: (1) the challenge of ensuring the objectivity of AWF test results; and (2) the lack of data on how a fast response, large bandwidth, square law detector would interact in a near field test.

C. The Way Forward

The C63.19 Standard is currently being re-balloted, and the recirculation version, rd 3.10, was released on November 7, 2005. It is the Incubator's recommendation that the dual banding version be balloted and accepted by the C63.19 balloting group. The Incubator will follow C63.19 rd 3.3, the last balloted version that was approved through the committee, if the re-balloting version is not completed in 2005.

[12] Given the number of unanticipated issues with the testing and measurement of WD compatibility with Hearing Aids in microphone mode, the Incubator's primary focus has been on compliance with the September 16, 2005, deadline. As the Incubator focuses more resources on compliance with the September 2006, deadline for T-coil compatibility, it anticipated that similar, previously-unanticipated technical issues may arise.

[13] CISPR stands for the "Comite International Special des Perturbations Radioelectriques."

Additional work that has been identified can be undertaken in 2006 by the ANSI Project Initiation Notification System (PINS) process of ASC C63. The Incubator has proposed a PIN for working on the AWF as well as T-coil test improvements.

V. AISP.4-HAC Working Groups

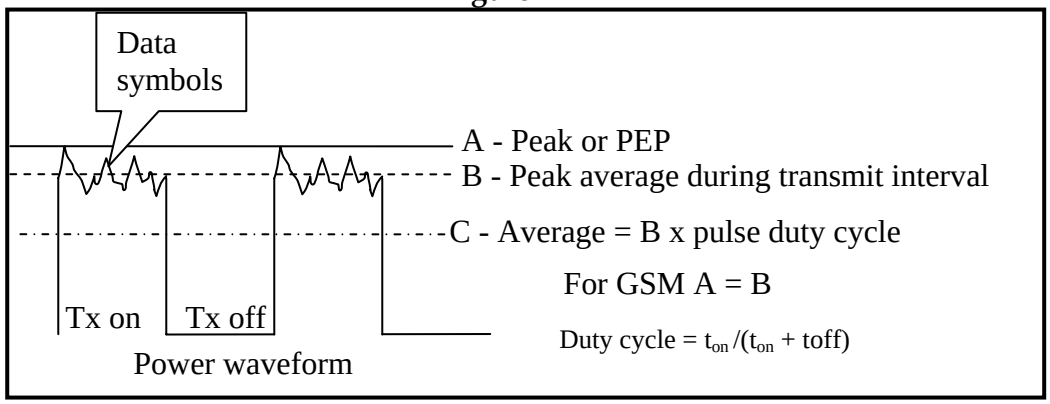
Working Groups have been formed within the Incubator to: (1) direct the focus of experts on specific issues; (2) promote effective member collaboration on ideas; and (3) document recommendations for review and discussion by the full Incubator. Each request for a working group must have a defined scope and specific deliverable. The full AISP.4-HAC then decides if the working group should be created. Once the deliverable is accomplished, the working group is dissolved. The working group deliverable is then brought to full AISP.4-HAC for adoption as an Agreement Reached. Currently, there are four (4) active AISP.4-HAC Working Groups: WG-4 Test Plan; WG-6 Labeling and Consumer Outreach; WG-8 Articulation Weighting Factor (AWF); and WG-9 850 MHz and Higher Power Challenges.

A. Test Plan Working Group (WG-4)

WG-4 has been working on issues related to the testing of WDs pursuant to the C63.19 Standard. WG-4's efforts include:

1) Interactions with ASC C63. The WG has held several calls with the leadership of ASC C63. These calls have resulted in the sharing of data that has clarified the "peak power" vs. "peak average power over the transmit interval" issue. It was agreed that the power fluctuations contained in peak power (illustrated by the Data Symbols in the sample *i*DEN waveform below) do not interfere with HA wearers' hearing perception. This is true for all non-TDM transmission methods. Therefore, WG-4 recommended the change to use peak average power over the transmit interval for RF emissions measurements.

Figure 1



2) Lab Comparison TMFS Testing. A round robin (RR) testing process was conducted to baseline Audio Band Magnetic (ABM) signal test measurements between participating labs. A Telephone Magnetic Field Simulator (TMFS) and test procedure were developed and circulated through a round robin process for all qualified lab participants.

   The test results are now more consistent between labs and outlying labs are retesting. The current results are displayed in **Attachment B**. However it should be noted that the TMFS is a low noise generator, and the signal- to-noise ratio will likely be higher when a WD is tested. The levels specified in the C63.19 Standard WDs are more stringent than those requirements for landline phones.

3) T-Coil Challenges. The aforementioned requirements raise significant new challenges. WDs must provide higher field strengths than a landline phone. The field gradients between radial measurements and axial measurements drop off quickly, making it difficult to reach the requirements at either of the two positions. Wireless devices are smaller than some of ABM devices on the market. Using a speaker coil in a wireless device is an option. However, driving the speaker to a higher level for T-Coil compliance also drives the audio level beyond the FCC limits.[14] A menu selection on the wireless device to separate the T-coil settings from the standard audio settings would eliminate this problem.

The WG will continue to discuss and exchange data on all collected T-coil ABM results. The WG will also evaluate the options of having a separate setting for T-coil that allows the magnetic signal to increase above the allowable audio levels. Any or all of these issues will have an impact on the C63.19 Standard as it is currently written.

B. Labeling and Consumer Outreach Working Group (WG-6)

WG-6 finalized two brochures to assist with outreach efforts. The first provides information targeted to hearing health professionals and was developed with assistance from representatives of the American Academy of Audiology, the American Speech Language and Hearing Association, the Academy of Dispensing Audiologists, and audiologists at Gallaudet University as well as representatives in the wireless industry and HIA. (See **Attachment C**). The second brochure (see **Attachment D**) was a collaborative effort among Self Help for Hard of Hearing People, Alexander Graham Bell Society, ASHA and representatives of the hearing health field as well as HIA and the wireless industry. This brochure, entitled "Get the Buzz Out," provides basic information to individuals who use hearing aids and want to know more about hearing aid compatibility with digital wireless cell phones. Both brochures will be made available at no charge from the AISP.4-HAC website (www.atis.org/hac/haclinks.asp) and CTIA (www.accesswireless.org).

[14] See 47 CFR §68.317.

Members of WG-6 and the ATIS HAC Incubator also presented information to consumers this summer at Self Help for Hard of Hearing People and the Telecommunications for the Deaf, Inc. national meetings. Brochures were made available at these events. WG-6 representatives also met with the FCC's Consumer and Government Affairs Bureau in September to share WG-6's outreach efforts.

CTIA-The Wireless Association's website (http://www.accesswireless.org) has been designated as the primary information portal on hearing aid compatibility for consumers. Work is on-going on accesswireless.org to encourage consumers to use this site's resources on HAC, including the establishment of direct links to information regularly updated by wireless companies. WG-6 is also working towards the release of an outreach effort targeted to over fifty organizations in the wireless, hearing health and consumer advocacy fields that will identify the many resources that have been developed through the ATIS HAC Incubator and CTIA's accesswireless.org.

C. Articulation Weighting Factor (WG-8)

WG-8 was established by the Incubator in May 2005 to investigate the use of the AWF to predict the potential for audible interference due to modulation rate and duty cycle factors of a specific air interface technology in the C63.19 Standard. The C63.19 Standard uses an AWF to characterize all air interfaces and adjust the limits that determine the rating of the handset. WG-8 has undertaken work to design an objective measurement for determining the AWF of future wireless technologies to assess their RF induced interference.

WG–8 conceived an alternative test method based on square law detection that might eliminate the need for the AWF and probe modulation. This alternative test methodology may provide a better predictor of HA compatibility than the current C63.19 Standard methodology. This new square law detection method is consistent with the methodology used to assess T-coil coupling interference. The new square law detection method could also eliminate many issues that cause lab inconsistency and repeatability while determining AWF. The use of a square law detector is wireless device transmission protocol neutral as it is based on the amount of interference detected in the hearing aid's audio frequency pass band. A white paper explaining the basis for this test methodology is provided as **Attachment E**.

C63.19 rd 3.6 added portions of AISP.4-HAC's work on this matter. WG-8 believes adding this work to C63.19 may be premature. While the square law detection method appears promising, additional work is anticipated to ensure that the fast, broadband, square law detector probes do not interfere with the near field measurements. The WG is continuing to address these issues and, once completed, the WG will submit its findings to C63.19 for inclusion in the 2006 Standard.

D. 850 MHz and Higher Power Challenges (WG-9)

WG-9 was commissioned by the AISP.4-HAC Incubator to examine issues surrounding WDs operating at the 850 MHz band with up to 2 watts of power. This was required by the fact that the dual band GSM phones operating in the US transmit up to 2 watts of output power at the GSM 850 MHz band as compared to 1 watt at 1900 MHz. This variation in frequency band and output power, along with the 5 dB AWF penalty[15] assessed against the GSM air interface, made it unlikely for any model to achieve compliance to the RF emission limits as specified in C63.19. While the primary focus of WG-9 was to address the problem associated with GSM at 850 MHz, other technologies were also examined.

At the September, 2003, HAC Incubator meeting, DELTA-TAL Laboratories from Copenhagen, Denmark, presented the results of their study of hearing aid immunity that had been commissioned by EHIMA. The study, which encompassed 350 hearing aids, indicated that hearing aid IRIL immunity had been increasing by 6 dB per year from 1997 to 2002 study timeframe, and that IRIL immunity at 850 MHz was from 9 to 13 dB better per year than at 1900 MHz. This data indicated that the HA user experience would be better at 850 MHz than at 1900 MHz for the same field strength intensity. The Working Group agreed that the C63.19 Standard did not consider or represent wireless devices operating at higher power (2 watts), and may have been overly restrictive on 850 MHz operation as compared to 1900 MHz.[16]

Two standards based data points that also support a frequency band differentiation are the IEC 60118-13 Standard and the Australian AS/NZS 1088.9:1995 Standard. While the absolute hearing aid required immunity levels are different between these two standards, the IEC Standard reflects a 3.5 dB difference between the two frequency bands; the Australian Standard a 3.1 dB difference.

An effort was undertaken by the Working Group to validate and quantify the band differences as a precursor to advocating that separate field measurements be reflected in C63.19 for the different bands. This effort resulted in a number of tests being conducted:

- *Cingular Handset Labs – Austin, TX – June 16-17, 2005*. Gallaudet University supplied 10 hearing aids for this testing; Starkey provided two. Subjective screening showed that only three of the hearing aids showed appreciable interference. Those three were tested with two GSM phone models (M3 at 1900 MHz and M1/M2 at 850 MHz) on both bands with the phones operating at maximum power under control of a Rhode & Schwarz CMU-200 base station simulator. Hearing aid interference was recorded with a Bruel & Kjaer 2144

[15] C63.19 (2001), Section 7.

[16] The EHIMA study data is a far field measurement. The WG is developing a method to mathematically convert the far field data to near field.

frequency analyzer and also with an SPL meter. Results showed that the interference into the three test hearing aids were lower at 850 MHz despite the higher TX power. (2 watts at 850 MHz vs 0.8 watts at 1900 MHz)

- *SHHH Convention – Washington, DC – June 30-July 2, 2005*. Subjective testing was performed with the cooperation of the 2005 SHHH Convention attendees. Testing utilized the same two models of GSM phones (actually 2 of each model) and a base station simulator. The phones were once again operated at high power, and the participants were asked to rate their experience and band preference. The data was taken double blind by computer, and a total of 99 persons were tested. The majority of the test subjects did not experience interference, but some experienced significant interference on both bands. Of those that expressed a preference for one band over the other, 60% preferred 850 MHz despite its higher TX power level.

An *ex parte* presentation was made to the FCC Wireless Telecommunications Bureau ("WTB") and Office of Engineering and Technology ("OET") on July 28, 2005, to present the results of this earlier testing. It was suggested by the FCC that the sample size of both phones and hearing aids should be expanded. This request precipitated the next round of testing:

- *Cingular Handset Labs – Austin, TX – August 4-5, 2005*. This round of testing utilized all 10 hearing aids previously supplied by Gallaudet University for the earlier round of testing. A total of 28 different models of dual band GSM phones were tested. Results again confirmed that operation at higher power at 850 MHz caused less interference into the hearing aids than did operation at lower power at 1900 MHz.

During subsequent presentation of this data to the HAC Incubator, it was suggested that the tests needed to be expanded to include other technologies to confirm that the frequency band differential was indeed a band specific phenomena and not air interface specific.

- *Handset Labs – Austin, TX – August 15-19, 2005*. This round of testing included other air interface technologies to confirm that the band differential observed for GSM applies to other air interface technologies as well. The same 10 hearing aids were supplied by Gallaudet University and were tested under similar conditions. A total of 4 GSM phones, 3 CDMA phones, 1 *i*DEN phone, and 2 IS-136 TDMA phones were tested. The CDMA and TDMA phones were also tested in AMPS mode. Due to the mode/band limitations, the *i*DEN and AMPS testing was confined to 850 MHz only, but was conducted as a comparison against the other air interfaces on that band. The results indicated that the frequency band differential did apply across all technologies.

An *ex parte* presentation was made to the FCC OET and WTB on August 24, 2005, to present the results of the last two rounds of testing. TEM Consulting was also utilized to benchmark the immunity of the 10 test hearing aids. This testing utilized both dipole and GTEM measurement methods.

- *EHIMA Hearing Aid Immunity Study Analysis- October 31, 2005.* DELTA-TAL Labs recently updated the EHIMA hearing aid immunity study to include testing of hearing aid from 2003 through 2005. The results of this study indicated slight additional improvements in hearing aid immunity and a slight additional widening of the IRIL frequency band differential. By applying techniques documented by the OU EMC Center[17] to predict the OIRIL (Overall IRIL) and to convert between near field and far field measurements, it was demonstrated that a frequency band field strength immunity differential of at least 10 dB existed. This latest data and its analysis were presented at the HAC Incubator meeting on October 31, 2005. It was agreed that a recommendation would be made from the HAC Incubator to the ANSI C63 committee to include a 10 dB field strength relaxation for WDs operating below 960 MHz. It was agreed that this relaxation would not impact any potential immunity requirements for hearing assistive devices. It was felt that this change in the Standard would be consistent with ensuring a comparable hearing aid user experience between the 850 MHz and 1900 MHz bands.

A written ex parte communication was made to the FCC OET and WTB on November 11, 2005, in order to relay the findings of the Incubators' analysis of the EHIMA study and the Incubator's agreement on the appropriateness of the 10dB frequency band differentiation in the C63.19 Standard.

A number of other solutions have been examined by the Working Group but were seen as less desirable options.

- *Lower Power Output*. As it appeared that compliance with the C63.19 Standard would not be achievable by the GSM phone manufacturers in the 850 MHz band, some parties suggested reducing the 850 MHz power output of GSM phones to reduce the field strengths enough to attain an M3 rating. Low power variations were examined, including lower output capability on 850 MHz, as well as a menu-selectable HAC option that would reduce output power only while in HAC mode. A complementary issue arose as to the impact that reduced output power could have on E-911 operation. The consensus reached was that requiring lower power operation at 850 MHz would be a disservice to both the HAC phone users and the wireless system operators. In weak signal areas, the HAC phone users would receive poorer service compared to "full power" users. The wireless system operators would have been forced to offer this degraded service to its HA

[17] "Modeling the Electromagnetic Response of Hearing Aids to Digital Wireless Phones," Robert E. Schlegel and F. Hank Grant, IEEE Transactions on Electromagnetic Compatibility, Volume 42, Number 4, November, 2000.

customers potentially resulting in poor service, dissatisfied customers, potential loss of customers, and loss of revenue. To compensate for the reduced coverage, the wireless system operators might also have been forced to add additional cell sites.

- *1900 MHz-Only Operation*. Some parties advocated the use of GSM phones that did not operate on the 850 MHz band as a way of achieving HAC. It was suggested that 1900 MHz coverage would be sufficient across all of the GSM wireless operators to provide service to the HA community. In reality, the HAC user would still suffer from reduced coverage compared to a dual band user due to lack of sufficient coverage, especially in rural areas where 1900 MHz GSM may not have been built out as extensively as had 850 MHz. Once again, it was felt that this option would have been a disservice to the HA user, and it was discarded.

- *Accessories*. The use of accessory devices on the phone to lower field strengths that impact the hearing aid were also considered. One accessory considered was an add-on spacer with an acoustic duct to increase the physical separation between the phone and the hearing aid. It was determined that in order to get sufficient separation, the thickness of such a device would make the phone undesirable to the customer. It would also create a problem with T-coil operation since the magnetic transducer in the phone would then be physically further away from the T-coil in the user's hearing aid. Similarly, shielding devices and external accessories were not deemed feasible solutions.

- *Directional Antennas.* The use of directional antennas has been advocated by third party antenna developers as a means to lower emissions in the direction toward the user's hearing aid. While the effects of beam shaping in the far field with these antennas are not disputed, indications are that the effect is not of benefit in the near field where the hearing aid is used. In the near field next to the phone, significant variations in the radiated field intensity are observed, thus negating the benefits of using directional antennas on the handset.

VI. Conclusion

The Incubator's members, and the wireless industry in general, have made tremendous progress in satisfying the Commission's requirements for hearing aid compatibility. The wireless industry has made available to consumers over sixty (60) wireless devices with lower RF emissions and with FCC granted M3 or better ratings. The wireless industry is continuing to release additional HAC devices for RF emissions and is currently working on the t-coil (magnetic coupling) compliance for 2006. The industry's work in bringing these products to market demonstrates its commitment to meeting the wireless needs of HA consumers.

The Incubator and its members continue to work diligently to clarify, revise and correct the C63.19 Standard in order to ensure that compliance is achievable and device testing can be accomplished in an accurate and repeatable manner through the use of the Standard. It is imperative that the recommended ATIS Incubator changes to the C63.19 Standard for frequency band differentiation between low and high bands, peak power definitions, the use of TMFS data for lab evaluation, and the AWF factors for new technologies be approved as written in order to promote accurate assessment at different bands, consistent testing, and valid measurement data when determining a hearing aid compatibility rating for the wireless device.

In addition, issues remain in ensuring compliance with the FCC's HAC regulations pertaining to T-coils and the ABM measurement. The ATIS Incubator will continue to investigate technical challenges surrounding HAC involving T-coils, and will suggest recommendations or clarifications (as needed) to the C63.19 Standard to ensure that the t-coil measurement requirements defined represent an accurate measurement assessment of the wireless device. The wireless industry will inform the FCC and the consumers through the ATIS Incubator of any and all recommended changes regarding T-coil HAC issues.

The wireless industry will continue its outreach efforts to consumers, hearing aid manufacturers, and audiologists providing literature updates and brochures on the latest available products, the understanding of the rating scheme for compatibility, along with continued participation at various exhibitor shows and events allowing consumers to evaluate and 'test drive' new wireless devices with their hearing aids. At the same time, the wireless industry will continue its design and development efforts to provide products and services that comply with the evolving Standard, and meet the needs of those consumers wearing hearing aids consumers.

WHEREFORE, THE PREMISES CONSIDERED, ATIS, on behalf of AISP.4-HAC, respectfully submits this fourth Report on Hearing Aid Compatibility Compliance Efforts for inclusion on the record in this proceeding.

Respectfully submitted by:

ATIS on behalf of AISP.4-HAC,

Thomas Goode
Associate General Counsel
ATIS
1200 G Street, NW
Suite 500
Washington, DC 20005

November 17, 2005

AISP.4-HAC REPORTING COMPANY MEMBERS

American Cellular Corporation
Alltel
Brookings Municipal Utilities d/b/a Swiftel Communications
Carolina West Wireless
Cingular Wireless LLC
Corr Wireless Communications, LLC
Cricket Communications
Dobson Cellular Systems, Inc.
Epic Touch
Hearing Industries Association
Immix Wireless
Key Communications
Keystone Wireless
Kyocera Wireless
Leap Wireless
LG Electronics, Inc.
Louisiana Unwired
Motorola, Inc.
NEC America, Inc.
Nextel Partners Inc.
Nokia
Qwest Wireless
Research In Motion Limited
Samsung Telecommunications America LP
Sprint-Nextel
Sony Ericsson Mobile Communications (USA), Inc.
Suncom
T-Mobile USA
UTSTARCOM
Verizon Wireless

List of Attachments

Attachment A – Model Form --Status Report on Hearing Aid Compatibility

Attachment A1 – Individual Status Reports on Hearing Aid Compatibility

Attachment B – TMFS Test Results

Attachment C – AISP.4-HAC Audiologist Brochure

Attachment D – AISP.4-HAC Consumer Brochure -- "Get the Buzz Out"

Attachment E – White Paper on Square Law Test Methodology

ATTACHMENT A

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name:	*b. Contact Name:*	
c. Address:		
d. City:	*e. State:*	*f. Zip Code:*
g. Phone:	*h. Fax:*	*i. Email:*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type

b. Total Number of Compliant Models:

c. Total Number of Models (US):

Section 3. Product Labeling Information

Section 4. Consumer Outreach Efforts

Section 5. Retail Availability of Compliant Models

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models
Section 7. Activities Related to ANSI C63.19 or Other Standards
Section 8. Efforts to Test Interoperability With Hearing Aids

Optional Information

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)
Section 10. Statement of Waiver and Status of Efforts Towards Compliance (Vendors or Service Providers who availed themselves of the FCC 05-166 Memorandum Opinion and Order released September 8, 2005)

ATTACHMENT A1

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: **ALLTEL**	*b. Contact Name:* **AMY OREM**	
c. Address: **ONE ALLIED DRIVE**		
d. City: **LITTLE ROCK**	*e. State:* **ARKANSAS**	*f. Zip Code:* **72202**
g. Phone: **(501) 905-7868**	*h. Fax:* **(501) 905-6299**	*i. Email:* **amy.orem@alltel.com**

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
V262	800/900/1900	CDMA	M3	IHDT56ET1	Class 2
V265	800/900/1900	CDMA	M3	IHDT56ET1	Class 2
V710	800/900/1900	CDMA	M3	IHDT56EC1	Class 2
6255i	800/1900	CDMA	M4	QMNRM-19	Class 2
KX1	800/1900	CDMA	M3	OVFKWC-KX1	Class 2

b. Total Number of Compliant Models: **4**

c. Total Number of Models (US): **13**

Section 3. Product Labeling Information

Nokia- The HAC addendum will be added to all sales packages and the gift box label will have the ANSI C63.19 Rating on it.

Motorola - All manuals and boxes will have HAC information on them. The manual will instruct people to look at the handset box to get the rating. The rating will be printed on the box, under the FCC ID, in the same font size.

Kyocera – does NOT label gift boxes

Section 4. Consumer Outreach Efforts

Customer can call into call center and will be directed to technical support where they can be informed of the phones that are HAC compatible, or customer can also access HAC compatible phones at http://alltel.com/phones/disability-access.html.

Section 5. Retail Availability of Compliant Models
Phones can be purchased at retail locations, telesales, or via www.shopalltel.com
Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models
Alltel will attempt to ensure compliance on devices launching in the future.
Section 7. Activities Related to ANSI C63.19 or Other Standards
N/A
Section 8. Efforts to Test Interoperability With Hearing Aids
Currently, Alltel does not test devices for HAC compatibility, but rather we rely on the phone manufacturers to certify compliance of HAC.
Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)
V265 and v710 available in Heritage Alltel markets only. V262, KX1, and 6255I available in all markets.

Cingular Wireless Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Cingular Wireless, LLC	*b. Contact Name:* Mike Roden	
c. Address: 5565 Glenridge Connector		
d. City: Atlanta	*e. State:* GA	*f. Zip Code:* 30342
g. Phone: 404.236.5894	*h. Fax:* 404.236.6116	*i. Email:* mike.roden@cingular.com

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
Nokia 6102h	800,1900	GSM	M3	PPIRM-77XH	Class 2 w/waiver
Samsung P207	800,1900	GSM	M3	A3LSGHP207	Class 2 w/waiver
LG C2000	800,1900	GSM	M3	BEJC2000	Class 2 w/ waiver
Samsung D307	800,1900	GSM	M4	A3LSGHD307	Class 2 w/waiver
Motorola V3	800,1900	GSM	M3	IHDT56EU1	Class 2 w/ Waiver

b. Total Number of Compliant Models: **5**

c. Total Number of Models (US): **22**

Section 3. Product Labeling Information

Due to the timing of the September 8, 850 MHz GSM Waiver Order one week prior to the September 16, 2005 effective date of the Hearing Aid Compatibility Order, many phones that suddenly became compliant were already packaged, shipped or ready to be shipped. Device manufacturers either A) placed a sticker on the phone box on initial shipments and then instituted a rolling change to the box text to reflect the rating or B) just instituted a rolling change to the box to reflect the rating. The wording on the box used was “Rated for Hearing Aids: M3” or “Rated for Hearing Aids: M4” depending on the rating. Call out cards next to HAC certified handsets in Cingular owned and operated stores included a handset’s HAC rating as well as information about other handset features. In addition, single page explanations of HAC, developed in

conjunction with consumer organizations, were provided to customers who purchased HAC compliant handsets.

Section 4. Consumer Outreach Efforts

Cingular Wireless chaired ATIS' WG-6 (Outreach and Labeling) and facilitated efforts to develop 3 brochures, each targeting industry, audiologists and other hearing health professionals, as well as consumers who use hearing aids. Cingular Wireless contributed to the list of over 50 hearing loss related organizations for a targeted outreach to their constituents. Cingular personnel also provided background information to American Academy of Audiology (AAA) and American Speech-Language-Hearing Association (ASHA) to assist with efforts helping audiologists better understand hearing aid compatibility and, in turn, helping hearing aid users who are interested in becoming digital wireless consumers. As part of a concerted outreach effort, Cingular representatives participated in presentations to Self Help for Hard of Hearing People's (SHHH) national convention as well as the biennial conference of Telecommunications for the Deaf, Inc. Cingular Wireless' Internet site includes background information on hearing aid compatibility as well as other options for individuals who are deaf or have a hearing loss. Included are useful links to disability related organizations including Self Help for Hard of Hearing People, the Telecommunications Rehabilitation Engineering Research Center at Gallaudet, and Telecommunications for the Deaf, Inc. ATIS WG-6 collaborated on "Get the Buzz Out" brochures and these were made available at Cingular Wireless owned and operated stores.

Section 5. Retail Availability of Compliant Models

Compliant models are available nationally in company owned or operated locations within each region and/or are available online at www.cingular.com. There are also 4 compliant models at a minimum available for demonstration at all company owned or operated locations nationally.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

In August 2005, Cingular's CTO forwarded a letter to each of Cingular's major handset suppliers' CTO reminding them of Cingular's September 2006 requirement to make available to consumers five (5) U3 (M3) rated handsets or twenty-five percent (25%) of the total number of handsets Cingular offers nationwide, and to offer at least two (2) digital handsets meeting the U3T (T3) performance level for providing magnetic coupling (telecoil) capability for each air interface offered. This communication stressed that handsets must meet the requirements at both 850 MHz and 1.9 GHz for GSM and GSM/UMTS as appropriate. Each supplier was required to acknowledge Cingular's September 2006 requirements and indicate their commitment to helping Cingular meet its HAC obligations. Additionally, Cingular initiated in the spring of 2005, and continues to conduct, regular weekly or bi-weekly technical calls with its major handset suppliers to monitor progress of incorporating and testing Hearing Aid Compatibility in new models.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Cingular Wireless was an invited voting participant member company of ANSI ASC C63 (American National Standards Institute Accredited Standards Committee on Electromagnetic Compatibility C63) and has been involved in the development of the latest version of the C63.19 – 2005 standard. Cingular Wireless has voted on all revisions to the C63.19 standard that ANSI ASC C63 has released within the last two years and is a participating member of C63 SC8 (Subcommittee 8 – Medical Devices and EMC). Cingular Wireless is also a member of AISP.4-HAC (Alliance for Telecommunications Industry Solutions [ATIS] Incubator Solutions Program 4 Hearing Aid Compatibility) and participates in all of the active working groups. Cingular Wireless has also contributed to the AISP.4-HAC Working Group 4 Test Plan: Hearing Aid Compatibility Technical Specification (HACTS). Cingular Wireless has also taken a key leadership role in the latest working group 9: 850 MHz and Higher Power Technology Challenges. WG-9 was commissioned by the AISP.4-HAC Incubator to examine issues surrounding WD operating at the 850 MHz band with up to 2 watts of power.

Section 8. Efforts to Test Interoperability With Hearing Aids

In working group 9, Cingular Wireless was instrumental in understanding the relationship of dual band wireless devices operation with hearing aids. This was undertaken by the fact that the dual band GSM phones operating in the US transmit up to 2 watts of output power at the GSM 850 MHz band as compared to 1W at 1900 MHz.

Efforts were undertaken within Working Group 9 to test dual band wireless devices with hearing aids. The key events that Cingular Wireless participated in included:

Cingular Handset Labs – Austin, TX – June 16-17, 2005. 12 hearing aids were tested with two GSM phone models (M3 at 1900 and M1/M2 at 850MHz) on both bands with the phones operating at maximum power under control of a Rhode & Schwarz CMU-200 base station simulator.

SHHH Convention – Washington, DC – June 30-July 2, 2005. Subjective testing was performed with the cooperation of the 2005 SHHH Convention attendees (99 participants). Testing utilized the same two models of GSM phones (actually 2 of each model) and a base station simulator.

Cingular Handset Labs – Austin, TX – August 4-5, 2005. A total of 28 different models of dual band GSM phones were tested with 10 hearing aids.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

As of November 1, 2005, a minimum of four (4) common HAC certified handsets are

offered at each company owned and operated location, and at Cingular on-line. Some locations may also have available additional HAC certified handsets (via the September 8, 850 MHz GSM Waiver Order) that are at end of product life and no longer in production. As new products are introduced, some may be HAC certified and could be offered at a limited number of locations or nationwide.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Leap Wireless/Cricket Communications	*b. Contact Name: Laurie Itkin*	
c. Address: 10307 Pacific Center Court		
d. City: San Diego	*e. State: CA*	*f. Zip Code: 92121*
g. Phone: 858-882-6226	*h. Fax: 858-882-6370*	*i. Email: litkin@cricketcommunications.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant
Kyocera KX9b	800/1900	CDMA	M3	OVFKWC-KX9	Class 2
Motorola V262	800/1900	CDMA	M3	1HDT56ET1	Class 2 Permissive change
Motorola V262	800/1900	CDMA	M3	1HDT56ET1	Class 2 Permissive change

b. Total Number of Compliant Models: 3

c. Total Number of Models (US): 7

Section 3. Product Labeling Information

The HAC compliant ratings are messaged on the exterior of the packaging for each handset, in the Phone Box Booklet for each handset, in the user manual for the Motorola handsets, on the price labels in all Cricket stores, and messaged on the product details page for each handset on mycricket.com website.

Section 4. Consumer Outreach Efforts

The product details page for each of the compliant handsets on mycricket.com identifies the rating and connects via hyperlink to the ATIS consumer brochure.

Section 5. Retail Availability of Compliant Models

HAC compliant handsets are available thru all Cricket retail stores and thru mycricket.com. Since Cricket is a Tier II carrier, we are mandated to provide at least two HAC compliant handsets.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

With all aspects considered, Cricket will place preference on the HAC compliant handset in the selection process. Also, Cricket will be identifying HAC compliance in our handset technical specification document and will continue to meet the FCC requirement for compliant handsets.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Section 8. Efforts to Test Interoperability With Hearing Aids

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

The HAC complaint handsets currently in our handset portfolio will be available in all Cricket retail markets.

American Cellular Corporation
Dobson Cellular Systems, Inc.
Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Dobson Cellular Systems, Inc. ("Dobson") & American Cellular Corporation ("ACC")[1]	*b. Contact Name:* Herbert Kenney	
c. Address: 14201 Wireless Way		
d. City: Oklahoma City	*e. State:* Oklahoma	*f. Zip Code:* 73134
g. Phone: 405-529-8336	*h. Fax:* 405-529-8765	*i. Email:* Herbert.Kenney@Dobson.net

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
Motorola V3	800/1900	GSM	M3	IHDT56EU1	Class 2 w/ Waiver
Motorola V220	800/1900	GSM	M3	IHDT56ER1	Class 2 w/ Waiver

b. Total Number of Compliant Models: 2

c. Total Number of Models (US): 13

Section 3. Product Labeling Information

Handset units shipped by manufacturer starting September 16, 2005 contain a label affixed to the unit's packaging indicating the M-rating of the phone, and an owner's manual addendum is included in the packaging that discusses the rating system. For inventory shipped prior to that date, labels and an owner's addendum were indirectly acquired from the manufacturer through a third party vendor and labels were then applied to existing inventory packaging and copies of the owner's addendum were also included in the packaging.

Section 4. Consumer Outreach Efforts

[1] Dobson and ACC are wholly-owned subsidiaries of Dobson Communications Corporation ("DCC") and are the two entities through which DCC provides wireless services to the public.

In addition to the outreach efforts undertaken by the ATIS HAC Incubator group in which Dobson and ACC are members (the "Incubator Group") that are discussed in the consolidated ATIS Hearing Aid Compatibility Status Report #4 ("Joint Report") filed contemporaneously herewith, Dobson and ACC have instructed their sales personnel on the availability of HAC compliant phone models and have instructed sales staff to direct those looking for such phones to these models. *See* Joint Report at Section V.B. Moreover, sales personnel have been instructed to inform hearing impaired individuals that there is a flexible return policy for HAC compliant phones, whereby the customer can cancel the service agreement and return the phone within 30 days of purchase without incurring any penalty or early termination charge if the customer is not satisfied with the handset's performance with the user's hearing aid. In addition, Dobson and ACC are in the process of (i) making sure that consumer outreach pamphlets, titled "Get the Buzz Out," are available to consumers at all Dobson/ACC retail outlets and (ii) updating its website to provide consumers with additional information on HAC compliant phones that are offered by Dobson/ACC. The handouts provide consumers with information on the FCC's requirements and the HAC rating system. To the extent that additional information is developed by industry or the hearing impaired community on the compatibility of certain phone models with particular hearing aids, Dobson/ACC will endeavor to make such information available to consumers.

Section 5. Retail Availability of Compliant Models

The HAC compliant models identified above are available in the more than 220 retail stores that are owned and operated by Dobson/ACC. HAC models are also on-hand in each store for live in-store testing. Finally, HAC compliant phones are available on-line at Dobson/ACC's website, *see* https://www.celloneusa.com/ECellPortal/ECell.portal.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Dobson and ACC are not manufacturers of handsets and lack the buying power of a national provider to influence handset design. Given the level of its purchasing needs, neither Dobson nor ACC is able to buy directly from manufacturers; rather, each company buys all of its handsets from third party vendors. Accordingly, Dobson and ACC are unable to dictate or otherwise persuade manufacturers to include certain HAC design elements in new models. However, participation in the Incubator Group does provide a forum by which Dobson/ACC along with other regional, national, and smaller service providers can provide suggestions and feedback to manufacturers as to design elements needed for the production of viable handsets that are HAC compliant. Moreover, the Incubator Group in which Dobson and ACC are voting members is working to modify the ANSI C63.19 standard to take into account the hearing aid frequency differential between the 850 MHz and 1900 MHz bands for GSM operations. *See* Joint Report at Sections IV and V.D.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Efforts on this point undertaken by the Incubator Group in which Dobson and ACC are voting members are detailed in the Joint Report and are incorporated herein by reference. *See* Joint Report at Sections IV and V.D.

Section 8. Efforts to Test Interoperability With Hearing Aids

Nothing to report at this time.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

N/A

Section 10. Statement of Waiver and Status of Efforts Towards Compliance (Vendors or Service Providers who availed themselves of the FCC 05-166 *Memorandum Opinion and Order* released September 8, 2005)

Dobson and ACC hereby notify the Commission that they are availing themselves of the temporary relief provided in the FCC's September 8, 2005 order that allowed, until August 1, 2006, for a dual-band GSM handset's HAC rating in the 1900 MHz band to be the overall compliance rating in both the 850 MHz and 1900 MHz bands. *See Section 68.4(a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones*, WT Docket No. 01-309, *Memorandum Opinion and Order*, FCC 05-166 at ¶ 23 (rel. Sept. 8, 2005) ("*MO&O*"). As required by the *MO&O*, Dobson/ACC has provided detailed information in Sections 2-7 above on its efforts: (i) to offer dual-band GSM handsets that achieve a rating of M3 or higher in the 850 MHZ band; (ii) to ensure that consumers seeking HAC phones have a 30-day trial period or flexible return policy; and (iii) to provide consumers with current technical and anecdotal information on HAC handsets. *Id*.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Epic PCS	*b. Contact Name: Mark Forbes*	
c. Address: PO Box 817		
d. City: Elkhart	*e. State: KS*	*f. Zip Code: 67950*
g. Phone: 620-697-2111	*h. Fax: 620-697-9997*	*i. Email: mforbes@epictouch.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
V555	1900/850	GSM		IHDT56EA1	
6230 Nokia	1900/850	GSM		QTKRH-28	
3100 Nokia	1900/850	GSM		PPIRH-50	

b. Total Number of Compliant Models: 8

c. Total Number of Models (US):

Section 3. Product Labeling Information

Point of Sale Collateral

Section 4. Consumer Outreach Efforts

Local Customer Service Assistance

Section 5. Retail Availability of Compliant Models

In Stock

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Consideration of variety, price and availability

Section 7. Activities Related to ANSI C63.19 or Other Standards
Compliant
Section 8. Efforts to Test Interoperability With Hearing Aids
Compliant
Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)
Local Customer Service Assistance

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Kyocera Wireless Corp.	*b. Contact Name: C. K. Li*	
c. Address: 10300 Campus Point Drive		
d. City: San Diego	*e. State: CA*	*f. Zip Code: 92121*
g. Phone: 858-882-3945	*h. Fax:*	*i. Email: cli@kyocera-wireless.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
KX1	800/1900	CDMA	M3	OVFKWC-KX1	Class 2
KX5	800/1900	CDMA	M3	OVFKWC-KX5	Class 2
KX5-5X0	800/1900	CDMA	M3	OVFKWC-KX5-5X0	Class 2
KX9	800/1900	CDMA	M3	OVFKWC-KX9	Class 2

b. Total Number of Compliant Models:
6

c. Total Number of Models (US):
>30

Section 3. Product Labeling Information

- Package label listing the HAC rating
- Instruction manual

Section 4. Consumer Outreach Efforts

Web pages to provide HAC information.

Section 5. Retail Availability of Compliant Models

HAC phones are available at Carrier Stores, retail and online.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

HAC is part of the design/development specifications. Kyocera is equipped with HAC testing equipment.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Participate in activities related to the HAC standards through the ATIS HAC Incubator and TCBC meetings.

Section 8. Efforts to Test Interoperability With Hearing Aids

- Participate in HAC interop testing through the ATIS HAC Incubator.
- Data comparison with external commercial test lab.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: LG Electronics Inc.	*b. Contact Name:* Eui soon, Park	
c. Address: 459-9, Kasan-dong, Kemchun-ku		
d. City: Seoul	*e. State:*	*f. Zip Code:* 153-023
g. Phone: 82-2-2033-3850	*h. Fax:* 82-2-2033-3855	*i. Email:* espark@lge.com

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
LG-VX3300	835/1900	CDMA	M3	BEJVX3300	Class II
LG-VX4700	835/1900	CDMA	M3	BEJVX4700	Class II
LG-VX9800	835/1900	CDMA	M3	BEJVX9800	Class II
LG-VX5200	835/1900	CDMA	M3	BEJAX5000	Class II
LG-VX8100	835/1900	CDMA	M3	BEJVX8100	Class II
LG-VX1000	835/1900	CDMA	M3	BEJVX1000	Class II
LG-LX225	835/1900	CDMA	M3	BEJLX125	Class II
LG-LX350	835/1900	CDMA	M3	BEJLX350	New Submission
LG-LX130	835/1900	CDMA	M3	BEJLX130	New Submission
L1400i	835/1900*	GSM	M3	BEJL1400	Class II
C2000	835/1900*	GSM	M3	BEJC2000	Class II
CE500	835/1900*	GSM	M3	BEJCE500	Class II

b. Total Number of Compliant Models: 12

* Compliance of these GSM phones at 835 is by virtue of the Cingular waiver.

c. Total Number of Models (US): 18

Section 3. Product Labeling Information

Mark and M-Rating indications on the Gift Box and HAC Statement on the User's Manual.

Section 4. Consumer Outreach Efforts

We have updated the information about HAC on our company's homepage.

Section 5. Retail Availability of Compliant Models

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

For RF Emissions
: We are planning to apply HAC to all models. In our CDMA phones and GSM1900, it is possible to meet the limit. But in case of GSM phones for GSM850, it is hard to meet the limit because the modulation factor is so high. The below are the method which we're debugging for HAC solutions.

1. Design : New mechanical design, changing angle in hinge part.
2. Antenna : Changing antenna location, using Internal antenna and directional antenna.
3. Speaker : Changing speaker location.
(Move speaker position to the location that is relative to lower the field strength.)
4. Field distribution: Analyzing the field (E & H) distribution.

HAC test result is affected with due to external design, e.g. type of Antenna and Speaker, so we are conducting further investigations about the correlation between those and HAC test result.

For T-coil
: A team was assigned to study Telecoil some months ago, we could check the following things.
First, the thinner mechanic material is, the more Telecoil test result improved.
Second, when Nonmetal and Circular Receiver are used, Telecoil test result are improved.
Third, the more turns of Speaker coil, the more Telecoil test result are improved.
Finally, when Telecoil isn't applied, field intensity and SNR of the Handset don't have any problems.
However, for frequency response, it's very sensitive to apply or not to apply Telecoil to the Handset.
We will apply Telecoil to products from next year because C63.19 for Telecoil is not fixed completely and it's believed C63.19 will be revised continuously. However, we will continue trying to improve the quality of sound and respond to new revision of C63.19 quickly.

Section 7. Activities Related to ANSI C63.19 or Other Standards

We are acting as AISP.4-HAC Members.

Section 8. Efforts to Test Interoperability With Hearing Aids

We did the interoperability test between Handsets and Hearing Aids.
In conclusion, we didn't feel any different between M1 and M3 Handsets.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

Section 10. Statement of Waiver and Status of Efforts Towards Compliance (Vendors or Service Providers who availed themselves of the FCC 05-166 *Memorandum Opinion and Order* released September 8, 2005)

We did Waiver for GSM850 band. In case of GSM phones for GSM850, it is hard to meet the limit because the modulation factor is so high. We're continuing to investigate the correlation between those and HAC test results." In addition, we are working with the carriers on an easy return policy for end users for HAC related issues.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Motorola, Inc.	*b. Contact Name: Mary Brooner*	
c. Address: 1350 "I" Street, NW, Suite 400		
d. City: Washington	*e. State: DC*	*f. Zip Code: 20005*
g. Phone: 202-371-6899	*h. Fax: 202-842-3578*	*i. Email: Mary.Brooner@motorola.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
I450	800/900	iDEN™	M3	AZ489FT5844	Class 2
I560	800/900	iDEN™	M3	AZ489FT5844	Class 2
I710	800/900	iDEN™	M4	AZ489FT5824	Class 2
I730	800/900	iDEN™	M4	AZ489FT5824	Class 2
I760	800/900	iDEN™	M3	AZ489FT5844	Class 2
I836	800/900	iDEN™	M3	AZ489FT5828	Class 2
I850	800/900	iDEN™	M3	AZ489FT5844	Class 2
i870	800/900	iDEN™	M4	AZ489FT5846	Class 2
V3	800/900/1800/1900	GSM	M3	IHDT56EU1	Class 2 w/ Waiver
V3	900/1800/1900	GSM	M3	IHDT56EU3	New Grant w/ Waiver
V220	800/900/1800/1900	GSM	M3	IHDT56ER1	Class 2 w/ Waiver
V220	900/1800/1900	GSM	M3	IHDT56ER2	New Grant w/ Waiver
V360	900/1800/1900	GSM	M3	IHDT6FF1	Class 2
E815	800/1900	CDMA	M3	IHDT56EL1	Class 2
E816	800/1900	CDMA	M3	IHDT56EL1	Class 2
V3c	800/1900	CDMA	M3	IHDT56FT1	New Grant
V260	800/1900	CDMA	M3	IHDT56ET1	Class 2
V262	800/1900	CDMA	M3	IHDT56ET1	Class 2
V265	800/1900	CDMA	M3	IHDT56ET1	Class 2
V266	800/1900	CDMA	M3	IHDT56ET1	Class 2
V276	800/1900	CDMA	M3	IHDT56ET1	Class 2
V323	800/1900	CDMA	M3	IHDT56FA1	Class 2
V325	800/1900	CDMA	M3	IHDT56FA1	Class 2
V710	800/1900	CDMA	M3	IHDT56EC1	Class 2

b. Total Number of Compliant Models: 8 iDEN; 5 GSM; 11 CDMA

c. Total Number of Models (US): 22 iDEN; 63 GSM; 25 CDMA

Section 3. Product Labeling Information

Manuals and package labeling information for the compliant models above was provided in accordance with the rule 20.19 and is available at the FCC OET web site.

Section 4. Consumer Outreach Efforts

Category ratings and a detailed explanation of the HAC system rating is available for iDEN products at http://idenphones.motorola.com/iden/products/products_home.jsp and for others at http://www.motorola.com/consumer/accessibility. Microphone and telecoil listening tests to compare different technologies (CDMA, GSM, iDEN and NADC) were conducted by 29 subjects (10 with cochlear implants) at the 2005 annual Self Help for the Hard of Hearing convention. A report of the experimental results was presented to the FCC during the 24 August ATIS Ex Parte meeting so a copy is not included herein.

Section 5. Retail Availability of Compliant Models

All major service providers and multiple retail stores offer Motorola products.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Though 3 of the iDEN protocol compliant models that were current models needed no change, over 2 man-years of engineering effort was consumed in designing the 5 other new models to meet the FCC compliance requirements. Finite element computer models and special test systems were developed as an aid in predicting and evaluating the performance of several models It was found that HAC compatibility is more sensitive to product physical design than SAR or ERP performance.

Section 7. Activities Related to ANSI C63.19 or Other Standards

- Motorola is participating in the C63 Medical Devices subcommittee 8 and attended the C63.19 drafting group and subcommittee 8 meetings April 27, 2005 and September 26, 2005.
- Motorola submitted detailed objection comments and objection reply comments on the ANSI Standards Action public review of PC63.19-2001.
- Motorola authored the ANSI Project Initiation Notification System (PINS) Form to standardize the subjective methodology used to determine currently adopted values of AWF.
- Motorola also is participating in ATIS working groups dealing with C63.19 issues.
    - WG-4 – Test Plan (Motorola – chair)

o WG-6 -- Labeling
o WG-8 – Articulation Weighting Factor (Motorola – chair)
o WG-9 – 850 MHz and Higher power

• Motorola has led the industry to examine the interpretation of how T-Coil measurements are made, and significant inputs were given to ATIS WG-4 as inputs to the fourth recirculation draft of C63.19.

Section 8. Efforts to Test Interoperability With Hearing Aids

Sample units, test equipment and technical support staff were provided for the RF frequency band-dependency measurements conducted at the Cingular testing laboratory at Austin, TX and reported on by the ATIS Incubator Working Group 9. Listening tests to compare different technologies (CDMA, GSM, iDEN and NADC) were conducted at the 2005 annual Self Help for the Hard of Hearing convention (see section 4 above).

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

Not Applicable.

Section 10. Statement of Waiver and Status of Efforts Towards Compliance (Vendors or Service Providers who availed themselves of the FCC 05-166 Memorandum Opinion and Order released September 8, 2005)

Motorola availed itself of the waiver relief for GSM 850/1900 handsets, noted in Section 2.a of this report. Our ongoing efforts to offer dual-band GSM 850/1900 handsets that achieve a rating of M3 or higher include investigating whether there are feasible and practical product designs capable of meeting the M3 requirements of the current standard and/or designs for meeting a potentially corrected standard. The proposed 10dB correction of the standard for the 850 MHz band to reflect empiric test results would greatly increase the likelihood of success. Motorola supports this amendment in Revision Draft 3.10 of the standard currently under ballot. We continue to work also on handsets that meet T3 measurements without relying on the waiver; however the potential pre-requisite of meeting M3 measurements in order to meet T3 in the testing protocols at section 7.3.3 of the standard is a concern.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: ***Nextel Partners***	*b. Contact Name:* ***Todd Lantor***	
c. Address: ***4500 Carillon Point***		
d. City: ***Kirkland***	*e. State:* ***WA***	*f. Zip Code:* ***98033***
g. Phone: 703 592-7185	*h. Fax: 952 828-0331*	*i. Email: Todd.Lantor@NextelPartners.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant
i730	800/900	IDEN	M4	AZ489FT5824	Class 2
i760	800/900	IDEN	M3	AZ489FT5844	Class 2
i836	800/900	IDEN	M3	AZ489FT5828	Class 2
i850	800/900	IDEN	M3	AZ489FT5844	Class 2
i560	800/900	IDEN	M3	AZ489FT5844	Class 2

b. Total Number of Compliant Models: 5

c. Total Number of Models (US): 19

Section 3. Product Labeling Information

All existing inventory has labels on the box and Hearing Aid Compatibility educational inserts were placed in the box. All new orders are shipped by Motorola with labels and educational inserts.

Section 4. Consumer Outreach Efforts

All company owned retail stores have Hearing Aid Compatibility signage and areas for consumers to test the phones. All retail sales representatives have been trained on HAC products and requirements.

Section 5. Retail Availability of Compliant Models

The above compliant models are available at all company owned retail stores.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

As an affiliate to Sprint Nextel, Nextel Partners relies on Sprint Nextel and Motorola to drive the development of Hearing Aid Compatibility phones for the Nextel Partners iDEN network.

Section 7. Activities Related to ANSI C63.19 or Other Standards

As an affiliate to Sprint Nextel, Nextel Partners relies on Sprint Nextel and Motorola to drive the development of Hearing Aid Compatibility phones for the Nextel Partners iDEN network.

Section 8. Efforts to Test Interoperability With Hearing Aids

As an affiliate to Sprint Nextel, Nextel Partners relies on Sprint Nextel and Motorola to drive the development of Hearing Aid Compatibility phones for the Nextel Partners iDEN network.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

All handsets are offered throughout the Nextel Partners service territory.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Nokia Inc.	*b. Contact Name:* David J. Dzumba	
c. Address: 6000 Connection Drive		
d. City: Irving	*e. State:* TX	*f. Zip Code:* 75039
g. Phone: **+**1 972 894 4722	*h. Fax:* **+**1 972 894 4706	*i. Email:* david.dzumba@nokia.com

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Air Interface(s)	ANSI C63.19 Rating	850 waiver
Nokia 6101 (h)	GSM 850/1900	M3	Yes
Nokia 6102 (h)	GSM 850/1900	M3	Yes
Nokia 6061	GSM 850/1900	M3	Yes
Nokia 6015	CDMA	M3	
Nokia 6255i	CDMA	M4	
Nokia 3155i	CDMA	M3	
Nokia 6256i		M4	

b. Total Number of Compliant Models: 8

c. Total Number of Models (US): Number of models offered at the discretion of carriers.

Section 3. Product Labeling Information

Compliant models include “M3” or “M4” text designation on the product box label.

Section 4. Consumer Outreach Efforts

Printed materials for carriers and retail outlets, and individuals, and product information online.

Section 5. Retail Availability of Compliant Models

Retail availability of devices at the discretion of carriers.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Nokia continuously evaluates our product portfolio and future product roadmaps to identify appropriate models for HAC in order to meet the needs of our carrier customers and our regulatory requirements.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Nokia is an active participant in the ATIS AISP.4-HAC incubator, which, among other activities, addresses interoperability and compatibility of wireless device with hearing aids as referenced in the 63.19 standard.

Section 8. Efforts to Test Interoperability With Hearing Aids

Nokia conducted Hearing aid measurement studies to understand the issues of distance and hearing performance for the different bands. This information was submitted to the Working Group as input to the banding difference.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Qwest	*b. Contact Name: Craig Kaiser*	
c. Address: 1801 California St.		
d. City: Denver	*e. State: CO*	*f. Zip Code: 80202*
g. Phone: 303-308-5632	*h. Fax: 303-672-5999*	*i. Email: craig.kaiser@qwest.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
SCP-2300	800, 1900	CDMA	M3	AEZSCP-23H	Class 2
SPH-a880	800, 1900	CDMA	M3	A3LSPHA880	Class 2
V710	800, 1900	CDMA	M3	IHDT56EC1	Class 2

b. Total Number of Compliant Models: 3

c. Total Number of Models (US): 11

Section 3. Product Labeling Information

Qwest is taking a multi-prong approach to labeling of the hearing aid compatibility rating. In cooperation with the device manufacturers, the HAC rating will be printed on the box of compliant handsets. Initially the Samsung A880 is the first Qwest device with the rating printed on the box. At Qwest company owned retail locations the rating is printed on the feature summary placed next to the phone in the display. The final labeling component is on the Qwest corporate website both on the disability outreach page (http://www.qwest.com/residential/disabled/index.html) and on the Qwestwireless.com web site. The rating of the compliant models will be listed among the individual handset features.

Section 4. Consumer Outreach Efforts

Qwest Wireless continues to work on the outreach aspects of the Commission's Order. As Qwest Wireless obtains and offers qualifying handsets that meet the specifications of the Order, it intends to communicate this information to customers in a variety of ways. These communication activities, may include posting the hearing aid-

compatibility ratings of the qualifying digital wireless phones on Qwest's corporate website; incorporating similar rating information in written material targeted to consumers; training sales personnel on the ratings of the handsets so that this information can be shared with customers as appropriate; and communicating the rating information to consumer and other advocacy groups.

Section 5. Retail Availability of Compliant Models

HAC phones are available at Qwest direct retail locations located in many shopping malls throughout our geographic region, online at Qwest.com, and thorough our call centers reachable through multiple toll free numbers.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Qwest continues to work with device manufactures to ensure ongoing support of Hearing Aid compatibility in new future devices.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Qwest encourages our suppliers to be actively involved with the standards bodies that are relevant to hearing aid compatibility as well as other wireless communication standards bodies.

Section 8. Efforts to Test Interoperability With Hearing Aids

Qwest believes that our handset providers are better equipped to perform interoperability testing with Hearing Aids.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

The compliant handsets are available in all of the areas where wireless service is offered by Qwest.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Research In Motion Limited	*b. Contact Name: Dave Dougall*	
c. Address: 295 Phillip Street		
d. City: Waterloo	*e. State: ON*	*f. Zip Code: N2L 3W8*
g. Phone: (519) 888-7465 ext 5380	*h. Fax: (519) 880-8193*	*i. Email: ddougall@rim.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
BlackBerry 7230	1900	GSM	M3	L6AR6230GE	Class 2
BlackBerry 7285	1900	GSM	M3	L6ARAP31GW	Class 2
BlackBerry 7250	800/1900	CDMA	M3	L6ARAR20CN	Class 2
BlackBerry 7130e	800/1900	CDMA	M3	L6ARAV20CW	New Submission

b. Total Number of Compliant Models: 4

c. Total Number of Models (US): 9

Section 3. Product Labeling Information

All compliant devices are marked on the product box label with the M-rating according to the labeling recommendations from ATIS WG-6. Within the box, the manual contains an outline explaining the HAC ratings which is based on the recommended description from WG-6.

Section 4. Consumer Outreach Efforts

RIM exhibited at the ATIS Wireless Center of Excellence at the 2005 SHHH Convention in Washington and at the 2005 TDI Conference in New Orleans allowing conference attendees to try various BlackBerry models. RIM also participated in the NAD 125th Anniversary Gala in Baltimore, the CHHA (Canadian Hard of Hearing Association)

Conference in Toronto in Oct. 2005, and in the Telecommunications Access RERC conference in early November on Accessible Emergency Notification and Communication held at Gallaudet University.

Section 5. Retail Availability of Compliant Models

N/A - Contingent on Carrier retail plans for these particular HAC models.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

RIM is actively investigating approaches for providing hearing aid compatibility in future models, both in terms of reducing RF emissions and for telecoil coupling.

Section 7. Activities Related to ANSI C63.19 or Other Standards

RIM is an active participant in the ATIS HAC Incubator, including AISP.4 – WG4 Test & Measurement Group, AISP.4 – WG6 on Product Labeling, AISP.4 – WG8 on AWF, and AISP.4 – WG9 on 850 MHz and Higher Power Technology Challenges.

Section 8. Efforts to Test Interoperability With Hearing Aids

RIM products are tested with the consuming public, including persons with disabilities. RIM provided hearing aid users with an opportunity to test its wireless devices at the 2005 SHHH Convention in Washington and at the 2005 TDI Conference in New Orleans.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Samsung Telecommunications America		*b. Contact Name: Kendra Green-Miller*
c. Address: 1301 Lookout Drive		
d. City: Richardson	*e. State: TX*	*f. Zip Code:75082*
g. Phone: 972-761-7123	*h. Fax:972-761-7678*	*i. Email:k.green@samsung.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
SCH-N330	800/1900	CDMA	M3	A3LSCHN330	Class 2
SCH-A630	800/1900	CDMA	M3	A3LSCHA630	Class 2
SCH-A850	800/1900	CDMA	M3	A3LSCHA850	Class 2
SPH-A840	800/1900	CDMA	M3	A3LSPHA840	Class 2
SPH-A880	800/1900	CDMA	M3	A3LSPHA880	Class 2
SGH-D307	850/1800/1900	GSM	M4	A3LSGHD307	Class 2 w/ Waiver
SGH-P207	850/1800/1900	GSM	M3	A3LSGHP207	Class 2 w/ Waiver
SGH-ZX10	GSM 850/900/1800/1900 WCDMA 850/1900	GSM/WCDMA	M3	A3LSGHZX10	New Grant w/ Waiver
SGH-T309H	1900	GSM	M3	A3LSGHT309H	New Grant
SGH-T309	850/1800/1900	GSM	M3	A3LSGHT309	Class 2 w/ Waiver
SGH-X495H	1900	GSM	M3	A3LSGHX495H	Class 2
SGH-T809	850/900/1800/1900	GSM	M3	A3LSGHT809	New Grant w/ Waiver

b. Total Number of Compliant Models:12

c. Total Number of Models (US): 25

Section 3. Product Labeling Information

The HAC rating for each of the above-listed handsets is provided on the packaging and in the user guide for each model, as provided by Samsung to its carrier customers. An explanation of the rating system is provided in the user guide. Samsung utilizes one of the formats of the HAC Incubator.

Samsung Telecommunications America (Samsung) offers two GSM handsets that meet the C63.19 standard (the T309H and X495H models) absent the relief afforded in the *Cingular Order*. Nevertheless, the *Cingular Order* facilitates Samsung's ability to offer several additional compliant models that operate at both 850 and 1900 MHz. WG-6 has recommended for HAC labeling.

Section 4. Consumer Outreach Efforts

Samsung provides product information on the HAC-compliant handsets offered by its carrier customers on its website, at http://www.samsungtelecom.com/contact_us/accessibility.asp, which is updated as Samsung's carrier customers begin offering Samsung products to their end user customers. Samsung has participated in ATIS HAC Incubator Working Group 6 addressing labeling issues and formats to help develop uniform industry-wide labeling for HAC compliant phones. Samsung also participated at the June 2005 annual Self Help for the Hard of Hearing (SHHH) convention to help educate and obtain feedback from consumers as to the capabilities of its handsets.

Section 5. Retail Availability of Compliant Models

10 of the 12 models listed above are currently commercially available at the retail level (or will be in the near future) via Samsung's carrier customers. Samsung does not sell handsets directly to end users (via the Internet or otherwise).

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Samsung conducts internal testing of its handsets to determine which products have potential for certification as HAC compliant. To the extent possible, Samsung has also incorporated HAC requirements and Commission deadlines into its product design and planning. With respect to T-Coil compatibility, ATIS has addressed relevant developments in its report. In the interim, Samsung has made a good faith effort to identify models which may meet the T-Coil requirement, and has identified two such models at this time. However, compliance will ultimately depend on the final test specification still in progress and, potentially, FCC staff instructions to TCBs.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Samsung is an active participant in the ATIS HAC Incubator Main Working Group, and is a Co-chair of Working Group 9 tasked with addressing issues concerning the M-rating of the C63.19 standard raised in the Commission's *MO&O*. In addition, Samsung has provided support to Working Group 8 (Articulation Weighting Factor) and Working Group 4 (Test Plan). As noted, ATIS has addressed relevant T-Coil developments in its report.

Section 8. Efforts to Test Interoperability With Hearing Aids

With respect to CDMA technology, Samsung designed such handsets to the C63.19 specification at the outset and is not aware of any hearing aid operability issues with respect to such handsets. With respect to GSM handsets, Samsung provided equipment for and participated in testing with ATIS at the SHHH convention, at which consumers were able to test various phone models and provide user experience data to ATIS. Samsung also has participated in Cingular's GSM HAC testing efforts.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

Not applicable.

Section 10. Statement of Waiver and Status of Efforts Towards Compliance (Vendors or Service Providers who availed themselves of the FCC 05-166 *Memorandum Opinion and Order* released September 8, 2005)

Samsung Telecommunications America (Samsung) offers two GSM handsets that meet the C63.19 standard (the T309H and X495H models) absent the relief afforded in the *Cingular Order*. Nevertheless, the *Cingular Order* facilitates Samsung's ability to offer several additional compliant models that operate at both 850 and 1900 MHz.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: Sony Ericsson Mobile Comm.	*b. Contact Name: Steven G Coston*	
c. Address: 7001 Development Drive		
d. City: RTP	*e. State: NC*	*f. Zip Code: 27709*
g. Phone: 919-472-7527	*h. Fax: 919-472-7451*	*i. Email: steve.coston@sonyericsson.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant
Z502a	1900	GSM	M3	PY7AF061011	New Grant
T292a	1900	GSM	M3	PY7A1061011	New Grant

b. Total Number of Compliant Models: 2

c. Total Number of Models (US): 16

Section 3. Product Labeling Information

Sony Ericsson mobiles are labeled 'Rated for Hearing Aids: M3' on the DPY packaging label in compliance with the FCC requirements for box labeling. The in-box documentation for HAC compliant models also has the supportive text providing info on HA compatibility, the rating, and the general information on Sony Ericsson Special Needs Center for the consumer.

Section 4. Consumer Outreach Efforts

Sony Ericsson products are available through either the web sites www.sonyericsson-snc.com or www.sonyericsson.com. SEM-SNC has met with various Audiologists and HA manufacturers, through HITEC, to provide information, brochures, and FAQ's to assist them in their direct conversations with consumers regarding available and compatible HAC wireless devices. HITEC continues to support over 2,000 audiologists and special needs equipment dealers nationally. Information on HAC is also being circulated to these groups. Additional wireless / HAC information can be found on the CTIA www.accesswireless.org web site.

Sony Ericsson continues to participate as an exhibitor in all SHHH Exhibitors Conferences allowing consumers to try wireless devices with their hearing aids worn. SEM has also attended the 2005 AAA (American Academy of Audiologists) conference held in Washington DC to meet with hearing aid professionals on products. Sony Ericsson has an ongoing dialogue with various consumer advocacy groups through its Special Needs Center partnership with HITEC Group International. HITEC has been in business for over 22 years and is a nationally and internationally recognized provider of assistive technology. Sony Ericsson combined with HITEC'S experience are able to reach a larger group of consumers, advocacy groups, and consult with audiologist and professionals on the latest hearing aids, in our outreach efforts.

Section 5. Retail Availability of Compliant Models

Retail Availability of compliant models is contingent on Carrier Retail Plans for these particular HAC models. SEM models offered are available on the following web sites:
www.sonyericsson-snc.com
www.sonyericsson.com
www.hitec.com

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Sony Ericsson is continuing an active investigation in its design efforts to provide hearing aid compatibility in future models. SE is also a Full Corporate Member of ANSI, and has recently filed for an additional membership of C63 Committee and SC-8 Working Group. SE has also participated in all scheduled mobile tests to assist in identifying and documenting changes submitted to ANSI C63 Std. SE has participated in multiple Carrier coordinated test events to support band differentiation between 850 and 1900 MHz. SE has also worked closely with HA manufacturers, testing HA products, evaluating compatibility to mobiles, and documenting these findings into submissions for the ANSI C63.19 STD and design guidelines for our Development Engineers to consider in early stages of product design.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Sony Ericsson is co-chair and an active participant in the ATIS HAC Incubator, including AISP.4-WG4 Testing Group, AISP.4-WG6 on Product Labeling, AISP.4 – WG8 on AWF, and AISP.4-WG9 850 MHz and Higher Power Levels. All of these groups are recognized contributors into the C63.19 Standard through the ATIS AISP.4 HAC Incubator. Sony Ericsson has requested membership in the C63 Committee to participate in the contributions and ballot review for edits and changes submitted on C63.19 Standard.

Section 8. Efforts to Test Interoperability With Hearing Aids

Sony Ericsson mobiles are evaluated by consumers wearing hearing aids at various exhibitor shows. Although this is subjective, it provides a 'litmus test' for the products and initial consumer impressions. Sony Ericsson has also purchased various hearing aids and conducts interoperability tests in-house on major suppliers of HA devices. Consultation with Audiologists and Hearing Aid manufacturers is allowing our products to be tested with some of the latest HAC devices worn by consumers.

Status Report on Hearing Aid Compatibility
(As of November 1, 2005)

Section 1. Company Information

a. Company Name: Sprint Nextel	*b. Contact Name: Ray Rothermel*	
c. Address: 2001 Edmund Halley Drive		
d. City: Reston	*e. State: Virginia*	*f. Zip Code:20191*
g. Phone (703) 433-4220	*h. Fax:(703) 433-4035*	*i. Email: Ray.Rothermel@Sprint.com*

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
i450 (*Boost Mobile*)	800/900	iDEN	M3	AZ489FT5844	Class 2
i560	800/900	iDEN	M3	AZ489FT5844	Class 2
i730	800/900	iDEN	M4	AZ489FT5824	Class 2
i760	800/900	iDEN	M3	AZ489FT5844	Class 2
i836	800/900	iDEN	M3	AZ489FT5828	Class 2
i850	800/900	iDEN	M3	AZ489FT5844	Class 2
i855 (*Boost Mobile)*	800/900	iDEN	M3	AZ489FT5844	Class 2
PM-A840	800/1900	CDMA	M3	A3LSPHA840	Class 2
MM-A880	800/1900	CDMA	M3	A3LSPHA880	Class 2
VI-2300	800/1900	CDMA	M3	AEZSCP-23H	Class 2
SCP-200	800/1900	CDMA	M3	AEZSCP-02H	Class 2
MM-5600	800/1900	CDMA	M3	AEZSCP-56H	Class 2
PM-225	800/1900	CDMA	M3	BEJLX125	Class 2
VI-125	800/1900	CDMA	M3	BEJLX125	Class 2
RIM 7250	800/1900	CDMA	M3	LGARAR20CN	Class 2

b. Total Number of Compliant Models: 15

c. Total Number of Models (US): 48

Section 3. Product Labeling Information

Sprint Nextel is labeling HAC compliant products by providing package labeling through its sales channels for products that had already been manufactured and distributed. Sprint Nextel is also working with its equipment vendors to begin printing hearing aid compatibility information on the original packaging. Additionally, Sprint Nextel provided labeling to help update "call out cards" that had been in place in company retail stores. Sprint Nextel anticipates that it will be able to print original materials for shelf displays that include hearing aid compatibility information.

Section 4. Consumer Outreach Efforts

Sprint Nextel posted information regarding hearing aid use with digital wireless phones on its website including a list of HAC compliant phones and their respective ratings. Sprint also worked with its handset vendors to revise user guides to include a section containing helpful consumer information about the ratings and interoperability with the consumer's hearing aid.

Through membership in ATIS and CTIA, Sprint Nextel also participated in several events that allowed interaction between consumers, service providers and manufacturers. Specifically, Sprint Nextel regularly participates in the Self Help for Hard of Hearing People (SHHH) Conventions. Sprint Nextel assists in other outreach activities, including producing consumer handouts to be distributed at the SHHH and the American Academy of Audiologists events.

Section 5. Retail Availability of Compliant Models

Compliant models are available in retail outlets, such as Sprint Nextel owned-and-operated retail stores, as well as via the company's website and telesales.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Sprint Nextel works with its multiple handset manufacturers to ensure its handset line-up includes the requisite number of compliant HAC phones.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Sprint Nextel is an active member of the ATIS AISP.4-HAC Incubator and has participated in several Incubator working groups.

Section 8. Efforts to Test Interoperability With Hearing Aids

Sprint Nextel, in cooperation with its phone manufacturers, continues to assist and monitor HAC interoperability test efforts through active participation in technical forums. Sprint Nextel teamed with the ATIS Incubator to test hearing aid device interoperability at SHHH conventions. In addition, Sprint Nextel conducted its own informal tests with individuals wearing hearing aids at the 20th International SHHH Convention.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

None.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: **SunCom Wireless, Inc.**	*b. Contact Name:* Charles Kallenbach	
c. Address: 1100 Cassatt Road		
d. City: Berwyn	*e. State:* PA	*f. Zip Code:* 19312
g. Phone: 610-722-4280	*h. Fax:* 610-722-4488	*i. Email:* ckallenbach@suncom.com

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant Type
Motorola V220	800/1900	GSM	M3	IHDT56ER1	Class 2 w/ Waiver
Motorola V3	800/1900	GSM	M3	IHDT56EU1	Class 2 w/ Waiver

b. Total Number of Compliant Models: 2

c. Total Number of Models (US): 29

Section 3. Product Labeling Information

On September 14, 2005, SunCom filed a request for temporary waiver of the Commission's HAC rules, due to the unavailability of HAC-certified dual-band GSM handsets. On October 14, 2005, due to recent HAC certifications resulting from the Commission's waiver order for dual-band GSM handsets (FCC 05-166), SunCom revised its waiver request to seek a shorter compliance extension, until December 1, 2005. In support of its requested extension, SunCom explained that it needed time, in part, to receive and distribute the appropriate product labeling materials which it expected to receive from the handset manufacturer. SunCom is currently in the process of ensuring that the labels and package inserts are received from its vendors and are distributed to SunCom's retail locations prior to December 1.

Section 4. Consumer Outreach Efforts

SunCom is currently planning a revision of its website which will include consumer information on HAC and will indicate which handsets available for purchase are HAC-certified.

For its retail stores, SunCom is in the process revising the handset display cards associated with SunCom's two HAC-certified models. The revised cards will indicate that the handsets satisfy the M3 HAC rating, thereby making it possible for customers to identify readily which handsets are hearing aid compatible.

SunCom is committed to a flexible return policy for hearing aid users who purchase a M3-compliant handset. SunCom currently has a 15-day return policy for its stores in the mainland U.S., but offers a 30-day policy for its stores in Puerto Rico. SunCom is in the process of determining how to transition to a 30-day policy for these customers in all of its stores.

Section 5. Retail Availability of Compliant Models

Both HAC-certified handset models are available on SunCom's website and in the vast majority of SunCom's retail stores. SunCom is in the process of identifying any stores that may still lack availability of either handset. SunCom expects to complete this process prior to the December 1 extension date sought in its pending waiver request.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

SunCom must rely on manufacturers to incorporate hearing aid compatibility into new models. SunCom will continue to seek information from manufacturers and/or their distributors regarding the future availability of handsets that comply with the HAC rules, including the requirement to satisfy the M3 standard at 850 MHz.

Section 7. Activities Related to ANSI C63.19 or Other Standards

SunCom is a member of the ATIS HAC Incubator (AISP.4-HAC), which is actively involved in assessing and recommending changes to the ANSI C63.19 standard. Also, as noted above, SunCom will continue to seek information from its vendors regarding the availability of handsets that satisfy the Commissions rules, including the requirement to conform to ANSI C63.19.

Section 8. Efforts to Test Interoperability With Hearing Aids

SunCom expects handset testing to be performed by the manufacturers.

Status Report on Hearing Aid Compatibility

(as of November 1, 2005)

Section 1. Company Information

a. Company Name: T-Mobile USA, Inc.	*b. Contact Name:* Harold Salters/Shellie Blakeney	
c. Address: 401 Ninth Street, NW, Suite 550		
d. City: Washington	*e. State:* DC	*f. Zip Code:* 20004
g. Phone: (202) 654-5900	*h. Fax:* (202) 654-5963	*i. Email:* First.Last Name @ T-Mobile.com

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Grant
RIM 7230 **Available on 9/16**	1900	GSM	M3	L6AR6230GE	Class II – Permissive Change
Samsung x495H **Available on 10/16**	1900	GSM	M3	A3LSGHX495H	Class II – Permissive Change
Siemens CF62T **Available on 11/16**	1900	GSM	M3	PWX CF-62	Class II – Permissive Change
Motorola V3 USA **Available on 11/16**	1900/800	GSM	M3	1HDT56EU1	Class II – Permissive Change w/ Waiver
Samsung t309 **Available on 11/16**	1900/800	GSM	M3	A3LSGHT309	Class II – Permissive Change w/ Waiver

b. Total Number of Compliant Models:

T-Mobile offers five (5) HAC compliant handsets. Two (2) HAC compliant handsets were available as of November 1, 2005, and three (3) additional models will be made available by November 16, 2005.

c. Total Number of Models (US):

T-Mobile offers a total of **20** models in the US.

Section 3. Product Labeling Information

Product labeling information has been included with T-Mobile HAC compliant handsets. Further, T-Mobile continues working with its vendors to facilitate the inclusion of appropriate HAC product information. Consistent with FCC requirements, all of the HAC compliant handset boxes are properly labeled.

Section 4. Consumer Outreach Efforts

T-Mobile continues working to provide its customers with current information on its HAC compliant products, in addition to the product labeling information mentioned above. T-Mobile's price/feature cards ("call-out cards") in its retail stores provide the M-rating for HAC-compliant handsets consistent with FCC requirements. In addition, T-Mobile is working to revise its "accessibility" web page, which will include additional information about the availability of HAC compliant handsets, as well as other useful information on disabilities access. Further, T-Mobile's customer care representatives stand ready to assist consumers with questions about and/or identifying HAC compliant products. This effort has been enhanced by the October 2005 inauguration of a dedicated toll-free TTY customer care number (877-296-1018) for use by T-Mobile customers. This TTY access is available 5 AM-10 PM (Pacific) daily.

Section 5. Retail Availability of Compliant Models

T-Mobile currently makes all of its HAC compliant products available via retail stores that are company owned and operated. Customers are able to test HAC handsets in T-Mobile's retail stores. Certain HAC compliant handsets (specifically the Motorola V3 and Samsung t309) are made available to consumers via the web at T-Mobile.com, in addition to T-Mobile owned and operated retail stores.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

T-Mobile works closely with its vendors on their efforts to incorporate hearing aid compatibility into new product offerings. Consistent with efforts described in Section 7 below, T-Mobile looks forward to an increased array of HAC-compatible wireless devices being available.

Section 7. Activities Related to ANSI C63.19 or Other Standards

T-Mobile is a charter member of the ATIS HAC Incubator as well as an active member/participant on the Incubator's WG-9. T-Mobile is vitally concerned that frequency banding differentiation between the 1900 and 850 MHz bands be reflected in the C63.19 standard. Employing 10dB differentiation will allow the M rating of low band handsets to more accurately reflect hearing aid users' true experiences with the

devices. In this manner, consumers will have a fuller-range of handset options for dual-band 850/1900 MHz models that provide them greater wireless coverage.

Section 8. Efforts to Test Interoperability With Hearing Aids

T-Mobile participated in the live, double-blind test of 1900/850 MHz handsets at the Self-Help for Hard of Hearing People annual convention in Washington DC June 30-July 3.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

None. There are no differences in T-Mobile's handset offerings.

Section 10. Statement of Waiver and Status of Efforts Towards Compliance (Vendors or Service Providers who availed themselves of the FCC 05-166 *Memorandum Opinion and Order* released September 8, 2005)

T-Mobile has availed itself of the relief afforded in the FCC 05-166 Memorandum Opinion and Order released on September 8, 2005, and is thereby permitted to offer dual-band (1900/850 MHz) GSM handsets. Further, the FCC 05-169 Memorandum Opinion and Order (granting T-Mobile's waiver request) released on September 16, 2005, requires T-Mobile to make available – one (1) HAC compliant handset by September 16, 2005; one (1) HAC compliant handset by October 16, 2005; and two (2) additional HAC compliant handsets by November 16, 2005. T-Mobile has satisfactorily met and exceeded the requirements outlined in the two aforementioned FCC actions by offering five (5) HAC compliant handsets by November 16, 2005. For additional information regarding these matters, please see T-Mobile's HAC Compliance Status Report filed on November 17, 2005, as a required condition of the FCC 05-169 Memorandum Opinion and Order.

Status Report on Hearing Aid Compatibility

(as of November 16, 2005)

Section 1. Company Information

a. Company Name: Cellco Partnership d/b/a Verizon Wireless	*b. Contact Name:* Michael Samsock	
c. Address: 1300 I Street, NW; Suite 400 West		
d. City: Washington	*e. State:* DC	*f. Zip Code:* 20005
*g. Phone:*202-589-3768	*h. Fax:* 202-589-3750	*i. Email:* Michael.samsock@verizonwireless.com

Section 2. Compliant Phone Model Information

a. Compliant Phone Models:

Model	Band(s)	Air Interface(s)	ANSI C63.19 Rating	FCC ID	Lab
LG: VX3300	800/1900	CDMA	M3	BEJVX3300	PCTEST Engineering Laboratory, Inc.
Samsung: N330	800/1900	CDMA	M3	A3LSCHN330	PCTEST Engineering Laboratory, Inc.
LG: VX4700	800/1900	CDMA	M3	BEJVX4700	PCTEST Engineering Laboratory, Inc.
Samsung: 630	800/1900	CDMA	M3	A3LSCHA630	PCTEST Engineering Laboratory, Inc.
Kyocera: KX1v	800/1900	CDMA	M3	OVFKWC-KX1	Compliance Certification Services
Audiovox: 180VW	800/1900	CDMA	M3	PP4TX-180	PCTEST Engineering Laboratory, Inc.
LG: VX5200	800/1900	CDMA	M3	BEJAX5000	PCTEST Engineering Laboratory, Inc.
Samsung A850	800/1900	CDMA	M3	A3LSCHA850	PCTEST Engineering Laboratory, Inc.
Motorola: V276	800/1900	CDMA	M3	IHDT56ET1	PCTEST Engineering Laboratory, Inc.
LG: VX9800	800/1900	CDMA	M3	BEJVX9800	PCTEST Engineering Laboratory, Inc.

RIM: Blackberry 7250	800/1900	CDMA	M3	L6ARAR20CN	PCTEST Engineering Laboratory, Inc.
LG: VX8100	800/1900	CDMA	M3	BEJVX8100	PCTEST Engineering Laboratory, Inc.
Motorola: E815	800/1900	CDMA	M3	IHDT56EL1	PCTEST Engineering Laboratory, Inc.
PalmOne: Treo 650	800/1900	CDMA	M3	O8FMADECA	Aprel Laboratories

b. Total Number of Compliant Models: 14 HAC compliant models

c. Total Number of Models (US): 27 models

Section 3. Product Labeling Information

Verizon Wireless has labeled HAC compliant phones in three ways:

(1) by the call out card;
(2) by indicating the M rating on the side of the phone's box;
(3) by including a brief description of the M rating in the phone's user manual or an insert enclosed in the phone's box.

Section 4. Consumer Outreach Efforts

Verizon Wireless's website has been updated to include information relevant to HAC. The website includes: (1) as description o the ANSI Standard (including the M rating); (2) a series of six common questions and their answers; (3) links to those phones that are HAC compliant.

Sales personnel at stores owned and operated by Verizon Wireless have been trained with an understanding of HAC and the phones offered by Verizon Wireless. Sales personnel may also access from the stores via the internet the information contained on Verizon Wireless' website (as described above).

Verizon Wireless has employees that are dedicated to disabilities issues including HAC. Those employees (1) regularly interact with customers who require additional assistance due to a disability; (2) participate in trade shows where they educate attendees on the HAC phones offered by Verizon Wireless; and (3) participate in national conventions offered by SHHH. In addition, Verizon Wireless is a scheduled participant at Gallaudet's Academic Bowl (April 2006).

Section 5. Retail Availability of Compliant Models

Verizon Wireless offers all of the models listed above as HAC compliant in Section 2(a) on a nationwide basis at its brick and mortar locations and via the internet. Some

locations that have restricted display space; kiosks for example, may not offer all of the models of a larger store. However, sales personnel at these locations have been trained to direct customers to the website or to larger, nearby Verizon Wireless locations.

Section 6. Efforts to Incorporate Hearing Aid Compatibility into New Models

Verizon Wireless continues to work with its OEMs to ensure that new models will be HAC compliant. Verizon Wireless and its OEMs are currently testing ten new models. Additional HAC models will be launched in 2006.

Section 7. Activities Related to ANSI C63.19 or Other Standards

Verizon Wireless is an active member of the Alliance for Telecommunications Industry Solutions ("ATIS"). Verizon Wireless is also a member o the balloting committee for the C63.19 revisions. As such, Verizon Wireless has contributed to the update being filed by ATIS on behalf of all of its member companies. Verizon Wireless refers the FCC to that report for additional information.

Section 8. Efforts to Test Interoperability With Hearing Aids

As part of its efforts described in Section 6, Verizon Wireless continues to test new models for HAC compliance.

Section 9. Information Regarding Differences in Handset Offerings Among Regions in Service Areas (Service Providers Only)

Verizon Wireless offers all of the models listed above as HAC compliant in Section 2(a) on a nationwide basis at its brick and mortar locations and via the internet. Some locations that have restricted display space; kiosks for example, may not offer all of the models of a larger store. However, sales personnel at these locations have been trained to direct customers to the website or to larger, nearby Verizon Wireless locations.

ATTACHMENT B

TMFS Results

LAB	Axial	Radial 1 Parallel to X Axis	Radial Parallel to Y Axis	Average Values Axial	Average Values Radial 1	Average Values Radial 2	Delta Axial	Delta Radial 1	Delta Radial 2	% Standard Deviation Axial	% Standard Deviation Radial 1	% Standard Deviation Radial 2
1	-19.7	-27.7	-27.6	-19.93	-27.17	-26.99	0.23	-0.53	-0.61	21.7%	15.2%	20.4%
2	-19.72	-27.02	-26.52				0.21	0.15	0.47			
3	-19.8	-27.1	-27.1				0.13	0.07	-0.11			
4	-19.3	-27.3	-26.8				0.63	-0.13	0.19			
5	**-22.1**	-27.5	-27.4				**-2.17**	-0.33	-0.41			
7	-19.5	**-25.7**	**-25.1**				0.43	**1.47**	**1.89**			
8	-20	-27.5	-27.5				-0.07	-0.33	-0.51			
9	-19.3	-27	-27.2				0.63	0.17	-0.21			
10	-20.1	-27.7	-27.7				-0.17	-0.53	-0.71			
							Standard Deviation Axial	**Standard Deviation Radial 1**	**Standard Deviation Radial 2**			
	Shaded are not consistent with other lab results						0.85	0.61	0.81			

Important Points My Clients Need to Know

- If the hearing aid will be coupled acoustically, look for cell phones rated M3 or M4 (as of September 2005).
- If the hearing aid will be coupled inductively (telecoil), look for cell phone rated T3 or T4 (as of September 2006).
- These M or T ratings should be used as a general guide to narrow the search for a cell phone to try out before making a purchase.
- Be sure the cell phone has an easy-to-use volume control.
- The ability to control backlighting of the display and keypad may be an important consideration for telecoil users. Interference from backlighting is not considered when determining a cell phone's HAC ratings. The ability to control some of these variables is available on some handset models.
- Hands-free Accessories: The M and T ratings will not preclude the need for hands-free accessories in some situations, such as use in the car or in noisy areas. The use of headsets or other accessories may still be necessary for cell phone use in some situations.
- Try before you buy!
- As of September, 2005, most stores owned and operated by wireless carriers will allow hearing aid users to try out cell phones in stores before purchasing them.
- Customers who want to try a cell phone outside of the store should ask how long they have to cancel the service and return a phone without penalty if the cell phone doesn't work with his/her particular hearing aid.
- It is the customer's responsibility to make sure any cell phone that doesn't work with his/her particular hearing aid is returned before any early termination fees go into effect.

Hearing Aid Requirements

In the United States, hearing aids are also rated for immunity to RF interference. The rating system is also defined by the ANSI C63.19 standard. The US ANSI C63.19 system gives a higher rating for hearing aids with better immunity. So, a hearing aid with an ANSI C63.19 rating of M4 should be more immune to interference than a hearing aid with a rating of M3. The rating of wireless devices uses the same principle.

The hearing aid ratings and the cell phone ratings can be combined to help identify combinations that will be more likely to provide a positive experience for the individual. A hearing aid rated M2 and a wireless device rated M3 combine to a rating of 5 and would likely provide "normal" use. A ratings combination of 6 would likely provide "excellent performance". Every individual's hearing loss is unique; therefore these ratings do not guarantee performance.

Most new digital hearing aids will have an immunity rating of at least M2. However, Audiologists, Physicians, and Hearing Instrument Specialists should be aware that not all "new" hearing aids will use RF immune components. Some older hearing aids may not use components that are immune to RF. Many older components that provide no immunity to RF are still on the market.

If the Audiologist, Physician, or Hearing Instrument Specialist has a question as to the immunity rating of a hearing aid or whether a hearing aid is using RF immune components, it is recommended s/he contact the individual hearing aid manufacturers.

Where Can I Find More Information?

ATIS AISP.4-HAC Incubator. (2005). Hearing Aid Compatibility with Wireless Devices: What Hearing Health Professionals Should Know. Audiology Today, 17(4), 20-21.

Levitt, H., Kozma-Spytek, L., & Harkins, J. (2005). In-the-ear measurements of interference in hearing aids from digital wireless telephones. Seminars in Hearing, 26(2), 87-98.

Victorian, T. & Preves, D. (2004). Progress achieved in setting standards for hearing aid/digital cell phone compatibility, The Hearing Journal, 57(9), 25-29.

Kozma-Spytek, L. (2003, December 8). Digital cell phones and hearing aids: frequently asked questions (and answers). Audiology Online. From http://www.audiologyonline.com/articles/arc_disp.asp?id=528

Kozma-Spytek, L. (2003). Hearing aid compatible telephones: History and current status. Seminars in Hearing, 24(1), 17-28.

Preves, D. (2003). Hearing Aids and Digital Wireless Telephones. Seminars in Hearing, 24(1), 43-62.

Sorri, M., Piiparinen, P., Huttunen, K., Haho, M, Tobey, E., Thibodeau, L. & Buckley, K. (2003) Hearing Aid Users Benefit from Induction Loop When Using Digital Cellular Phones. Ear & Hearing, Vol. 24 (2), 119-132.

Kozma-Spytek, L. (2001, February 12). Digital wireless telephones and hearing aids. Audiology Online. From http://audiologyonline.com/articles/arc_disp.asp?id=278

Digital Wireless Telephones and Hearing Aids: A New Challenge for Audiology. (2001) Journal of the American Academy of Audiology (Special Issue), Vol. 12 (6).

Developed by:

The Alliance for Telecommunications Industry Solutions (ATIS) Hearing Aid Compatibility Incubator, with CTIA–The Wireless Association®, and the Academy of Dispensing Audiology, Alexander Graham Bell Association for the Deaf and Hard of Hearing, American Academy of Audiology, Gallaudet University Technology Access Program and the Department of Hearing, Speech, and Language Sciences, Hearing Industries Association, and Self Help for Hard of Hearing People, Inc.

ATTACHMENT C

Hearing Aid Compatibility With Digital Wireless Cell Phones:

PHOTO: Oticon

An Update for Audiologists, Physicians, and Hearing Instrument Specialists

Q. How will I know if a phone is HAC-compliant?
A. HAC-compliant device packages are marked with "M3" or "M4" ratings. The M-rating refers to the microphone mode. Only phones that meet HAC compliance will be labeled as such. If you see a "M3" or "M4" on the box then the phone has been designated as HAC compliant. Information about phones that meet the standard will also be shown on the display card by the phone in service provider operated retail stores and in the product's manual or packaging insert. If you have questions about the rating of a wireless device or service, ask your service provider or device manufacturer for more information.

Q. May I try the phone before I buy?
A. It's best to try several phones before buying to find the best match with your hearing aids. Visit a full-service carrier store and ask to try phones that have been designated as "hearing aid compatible." After September 2005, stores owned and operated by a wireless service provider will provide you with an opportunity to try out phones.

Q. Can I return the phone if it does not work for me after purchase?
A. Be sure to understand the return policy and early termination fees before signing up for any cell phone or service. Since a cell phone's RF emissions can change depending on your location your listening experience outside the store may be different.

Q. Do HAC compliant cell phones look any different from other cell phones?
A. No.

Try before you buy. It's best to try several phones before making your purchase to find the best match with your hearing aid.

New Technologies in hearing aid, wireless industries unleash a swarm of **choices in communication**

Many new digital hearing aids are designed to be usable with wireless devices with lower RF emissions. Of the more than 2 million hearing aids sold in 2004, eighty percent (80%) include a basic circuitry design that increases immunity to interference.

Hearing loss and hearing aids are highly individualized. While FCC Hearing Aid Compatibility (HAC) regulations should improve cell phone usability for hearing aid users,some may still not find a cell phone that works for them at this time. If you can not find a cell phone that works for you, you may wish to consider the use of an accessory device to aid your cell phone use. Accessories such as inductive neckloops, inductive silhouettes, and direct-audio-input-modified earbuds help to reduce interference, especially for t-coil users.

RESOURCES

Many people and organizations contribute to ensuring accessible communication is equally available for all individuals with disabilities including deaf and hard of hearing consumers. For more information for consumers on HAC wireless visit:

http://www.accesswireless.org

"Getting the buzz out" courtesy of the **Alliance for Telecommunications Industry Solutions Hearing Aid Compatibility Incubator** and **CTIA- The Wireless Association™**

ATTACHMENT D

Hearing Aid Compatibility

with

Digital Wireless Devices

Get the BUZZ Out.

CHOOSING AND USING A **DIGITAL WIRELESS DEVICE** WITH YOUR HEARING AIDS

To ensure everyone benefits from advances in technology, the Federal Communications Commission ("FCC") has approved standards and passed regulations for digital wireless device use with hearing aids. In 2001, the FCC modified the exemption for wireless phones under the *Hearing Aid Compatibility Act of 1988* in light of the rising number of wireless calls to emergency services and the growing trend among wireless carriers to move away from analog services in favor of more efficient and feature-rich digital services."

Q. What does hearing aid compatibility (HAC) mean for wireless devices?
A. The FCC defines HAC for cell phones in terms of two parameters; radio-frequency (RF) emissions and telecoil coupling. Cell phones that comply with the FCC's hearing aid compatibility rule must receive a minimum rating of M3 for RF emissions and T3 for telecoil coupling.

Q. When will hearing aid compatible cell phones be available?
A. The FCC requires that nationwide carriers offer a range of phones that comply with HAC regulations beginning in September 2005 for microphone mode and in September 2006 for telecoil mode. Many regional carriers will also offer phones and support.Some cell phones that are usable with hearing aids are already on the market.

Q. Does the new FCC regulation guarantee that I will be able to use a cell phone with my hearing aid?
A. While there is no guarantee; phones that comply with Hearing Aid Compatibility (HAC) regulations should improve usability for hearing aid users. Hearing loss and hearing aids are highly individualized so it is still advisable to try a cell phone with your hearing aid in the store before making your cell phone purchase.

Q. Who manufactures digital wireless devices that have been approved by the FCC?
A. All major handset manufacturers are required to offer HAC-compliant devices and may also offer hands-free accessories to improve usability.

Q. Are HAC-compliant phones more expensive than phones without hearing aid compatibility?
A. No. The range of features and functions of cell phones will impact the price, but hearing aid compatibility will not. Service provider owned and operated stores will offer a range of phones with varying features and prices.

Q. What does "M" on the label mean?
A. "M" refers to the phone's RF emissions level and is intended for use with hearing aids in the microphone mode. The higher the "M" rating on the phone the more likely it is you will be able to use the phone with your hearing aid on the microphone setting.

Q. I already have a cell phone. May I trade it in for a new hearing aid compatible phone?
A. Consult with your service provider.

Get the BUZZ Out.

Advancements in cell phones and hearing aids offer consumers with hearing loss more freedom to use digital wireless devices, increasing the likelihood consumers will be able to find a cell phone they are **able to use**.

Q. What does the " T" on the label mean?
A. "T" refers to the phone's coupling ability and is intended for use with hearing aids in the telecoil mode. The higher the "T" number the more likely you will be able to use the phone with your hearing aid on the telecoil setting.

Q. How do I know if my hearing aids will work with my cell phone?
A. Your hearing healthcare professional will be able to tell you if your hearing aid is immune to RF interference and may need to contact the manufacturer of your hearing aid to determine its immunity rating.

Q. Are there phones I can use with my hearing aid on the telecoil setting?
A. There may be phones already on the market that work with telecoils but they are not yet labeled. The FCC regulations require that cell phones be manufactured for use with hearing aids on the telecoil setting by September 2006. They will be labeled on the box with ratings of T3 or T4.

Q. What if I cannot find a cell phone that works with my hearing aid?
A. You can check with your hearing healthcare professional to determine if there is a hearing aid option for you that may work better with cell phones. Some telecoil users may find that accessories such as neckloops may further assist with their use of wireless devices until cell phones are tested and rated for telecoil compatibility, and for using non-rated cell phones.

ATTACHMENT E

Square Law Application to Hearing Aid Compatibility

Al Wieczorek and Scott Isabelle, Motorola, Inc.
September 23, 2005

In Hearing aid standard C63.19-2005 a note immediately following Table 7-4 states *It should be noted that because the common interference response of hearing aid circuitry is proportional to the square of the RF field, a 5 dB change in the RF field yields a 10 dB change in the interference level.* On a linear rather than a logarithmic basis this equivalently states that the change in the hearing aid audio frequency interference level is in proportion to the square of the change in the radio frequency RF field incident upon it from a radiotelephone handset.

A rectifier diode used to convert AC to DC follows this same "square law" principle. Chapter 2 of Interference to Hearing Aids by the Digital Mobile Telephone System (National Acoustic Laboratories Report No. 131) states, "*Amplitude variations (i.e. – amplitude modulation) of the radio frequency field are said to be "detected", i.e. they are rectified by the amplifier input transistor and appear in the acoustic output of the hearing aid where they may be heard loudly enough to be annoying and interfere with hearing aid use. Detection is discussed in Appendix 4, where it is shown how audio frequency voltages of comparable magnitude to those produced by the microphone can be produced by "unsuppressed" amplitude modulated radio frequency voltages.*" Appendix 4 states that the equations show that, "*The magnitude of the "detected" signal is proportional to the square of the magnitude of the RF carrier signal.*"

Square Law mathematics

For a rectifier diode, the output current is a square law function of the voltage applied across its junction. A similar characteristic occurs for the bipolar transistor output current due to the voltage applied to the base-emitter junction, and to the more modern MOSFET transistor amplifier. A graphical representation of this process can be found in Figure 13-4, Electrical Engineering Circuits by H.H. Skilling.

Mathematically, the square law relationship is of the form of a second order equation like that in the following series:

$$\varphi = a_o + a_1 e + a_2 e^2 \qquad 1)$$

and symbolically it can be represented as

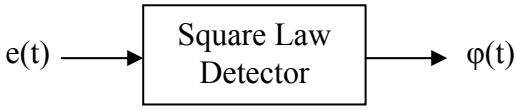


Figure 1- Square law block diagram

Since the hearing aid audio band acoustic transducer linearly converts the amplifier output current to an acoustic output signal equation 1 is stated to relate the hearing aid acoustic signal amplitude (φ) to the strength of the incident RF field intensity (e).

An unmodulated continuous wave (CW) radio frequency (RF) signal of radian frequency ω is used as the incident signal in measurements per C63.19-2005. This signal may be represented by

$$e_{CW} = E\cos(\omega t) \qquad 2)$$

Inserting equation 2 into equation 1 results in the following representation of the acoustic output signal:

$$\varphi_{CW} = a_o + a_1 E\cos(\omega t) + a_2 E^2\cos^2(\omega t) \qquad 3)$$

or equivalently via trigonometric identity as

$$\varphi_{CW} = a_o + a_1 E\cos(\omega t) + a_2 E^2(1 + \cos(2\omega t))/2 \qquad 4)$$

This is seen to consist of 2 components, a non time varying DC component equal to

$$\varphi_{CW}(DC) = a_o + a_2 E^2/2 \qquad 5)$$

and a time varying multiple sinusoidal AC component equal to

$$\varphi_{CW}(AC) = a_1 E\cos(\omega t) + a_2 (E^2/2)\cos(2\omega t) \qquad 6)$$

The hearing aid acoustic transducer and the human ear are capable of hearing an output signal only from an audio band signal so no acoustic output will be heard from the non time varying subaudible DC component produced by rectification. Mathematically, this means that time varying AC terms involving only the modulating frequency need be considered as the ultrasonic RF frequencies also will not be heard. Functionally, this is the equivalent of a band pass filter following the square law detector, as shown in Figure 2.

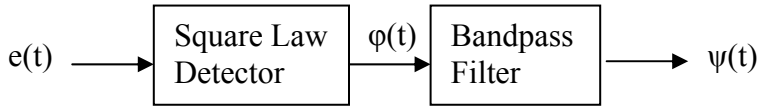


Figure 2 – Filtered hearing aid square law detector

However, the added DC component may serve to rebias the amplifier and alter its gain such that the output from any acoustic signal incident on the hearing aid may be affected. Gain change due to rectification is a factor in the C63.19 methodology for rating hearing aids. There also may occur a DC transient impulse step when the signal is first applied, and again when it is removed. Being a low frequency occurrence, this factor is ignored in C63.19. However, it can be a factor in signals with recurrent

pulsations as a signal will be generated at the pulsing rate of amplitude equal to the DC step size, $a_2 E^2/2$. This signal is of equal amplitude to the AC component at frequency 2ω, both of which increase with the square of the incident signal field intensity.

It is seen in equation 6 that the output signal is in the RF band and also contains a signal at frequency 2ω which was not present in the incident signal. This doubled frequency is a second harmonic distortion RF signal produced by the nonlinearity of the diode, but also is inaudible and of no consequence to hearing aid assessment.

Considering both the DC and AC effects of the square law, no audible sound emanates from a hearing aid exposed to a continuous wave (CW) RF signal like that used to calibrate a dipole antenna per the C63.19-2005 standard. The result is different for a time varying amplitude modulated (AM) signal to measure hearing aid immunity per C63.19-2005. This sinusoidal signal of audio radian frequency μ and modulation index m is described by the equation

$$e_{AM} = E\,(1 + m\cos(\mu t))\cos(\omega t) \qquad \text{where } 0 \le m \le 1 \qquad 7)$$

Squaring and trigonometric substitution leads to

$$e^2_{AM} = E^2\,[(1+ 2m\cos(\mu t) + m^2(1+ \cos(2\mu t))/2]\,(1 + \cos(2\omega t))/2 \qquad 8)$$

Since ultrasonic terms including the factor $\cos(2\omega t)$ can be ignored as they cannot be heard this leads to the following simplified audible AC part of e^2_{AM} and φ_{AM} as

$$e^2_{AM} = E^2\,[(1+ m^2/2)+ 2m\cos(\mu t) + (m^2/2)\cos(2\mu t] \qquad 9)$$

and

$$\varphi_{AM} = a_o + a_1 E + a_2 E^2\,[(1+ m^2/2)+ 2m\cos(\mu t) + (m^2/2)\cos(2\mu t)] \qquad 10)$$

Expanding and regrouping terms leads to

$$\varphi_{AM}(DC) + \underline{\varphi_{AM}(\mu)} = [a_o + a_1 E + a_2 (1+ m^2/2) E^2] + \underline{[2\, a_2\, m\, E^2 (\cos(\mu t) + (m/4)\cos(2\mu t))]} \qquad 11)$$

for the unfiltered components and

$$\psi(t) = H(f)\, P(f)\, \varphi_{AM}(\mu) \qquad 12)$$

for the filtered components, where

H(f) = hearing aid filtering function and
P(f) = user perceptual filtering function

Equation 11 shows that the strength of the detected audible output signal $\varphi_{AM}(\mu)$ occurs at both the modulation frequency (μ) and at its second harmonic (a distortion

component), the latter of reduced amplitude (m/4) compared to the fundamental. Of importance is that the strength of the AC signal is seen to be dependent upon the modulation depth, the square law second order detector sensitivity coefficient, and the square of the RF field strength. The latter is the basis for the 2:1 relationship for applying AWF. Thus interference from a handset operating at 2 watts will be 6 dB more than when it is similarly operating 3 dB lower at 1 watt. Equally important, the strength is also clearly independent of both the modulating frequency and the RF frequency. Thus interference power from a multiband handest operating at one band will be the same as when similarly operating in another band, but hearing aid immunity may differ and thus so also might the user experience.

Modulation spectrum considerations

Most cellular transmission protocols utilize a modulation form more complex than that of a single AM modulation tone (μ) applied to a single tone carrier frequency (ω). For example, the popular ON/OFF keyed constant envelope TDM signal (see Figure 3) can be readily described mathematically via a Fourier series of multiple modulating tones resulting in a series of audible signals that are harmonics of the pulse repetition rate. This will result in a discrete spectrum of signals that can be mathematically expressed by a series of equations like equations 11 and 12, one for each component frequency in the Fourier series. Figure 4 below shows the discrete line spectrum that resulted when the digitized cellphone transmission power envelope waveform of Figure 3 was transformed to the frequency domain using a Fast Fourier Transform (FFT). Note that many discrete harmonics lie in the 300 to 3 kHz speech pass band. The duty cycle of the keyed TDM signal will affect the number of repetition rate harmonics and their amplitude.

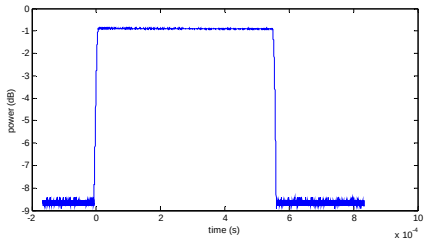


Figure 3 – Captured digitized GSM pulse power waveform (217 Hz repetition rate)

TDM protocols in current use span a nearly 20:1 repetition rate range from a sub-audible 11 Hz to a mid-range 217 Hz and their audibility depends on the repetition rate. Figure 5 shows the hearing aid detected spectrum of a TDM transmission protocol that transmits at a 22 Hz repetition rate the non-constant power envelope shown in Figure 4. This spectrum shows two component types, discrete lines due to the 22 Hz keying rate and spread spectrum like components due to 4 kHz pseudorandom power envelope amplitude variations evident in Figure 5. The total amount of signal power in both spectrograms is equal but substantially less interference will be heard from a hearing aid used with the iDEN transmission protocol because less power is detected in the audible pass band; it is primarily in the subaudible region below 300 Hz. Figure 5 is aligned with Figure 4 and lines are drawn between them to facilitate this comparison.

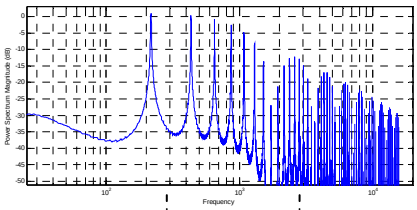


Figure 4 – Spectrogram of Fig. 3 waveform at 1:8 duty cycle

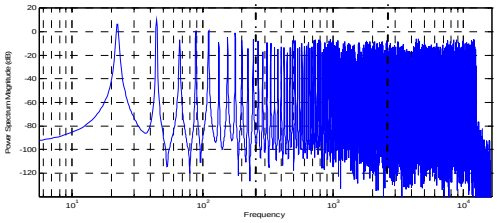


Figure 5 – Spectrogram of Fig. 6 waveform at 1:3 duty cycle

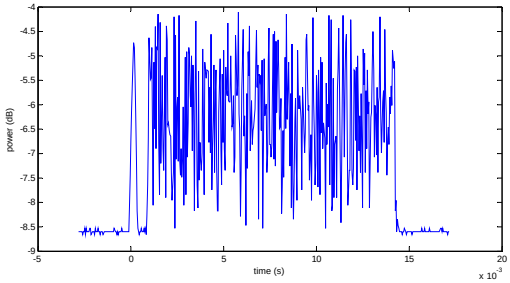


Figure 6 – Captured digitized iDEN pulse waveform (22 Hz repetition rate)

These spectral characteristics evident due to mathematical signal processing of captured digitized handset power waveforms that illustrate hearing aid effects due to ON/OFF keying and power envelope peaks are corroborated in the measured hearing aid output spectrograms of Figures 5 through 8 published in the IEEE Transactions on Rehabilitation Engineering, vol. 6, No. 2, June 1998 by Marlene Skopec of the FDA entitled Hearing Aid Electromagnetic Interference from Wireless Telephones. (Copy available on request.) Acoustic gain changes due to rebiasing is also evident in those figures by observing the amplitude of the applied white noise acoustic signal. Figure 4 in that hearing aid compatibility study appears to show the hearing aid pass band filtering function (H(f) in equation 12) by examining the shape of the white noise acoustic input passed through the specimen hearing aid. The perceptual filter (P(f) in equation 12) was not part of that study; however, the Fletcher- Munson equal loudness contour curves shown below, based on their work at Bell Labs in the 1930's led to a well known example known as an A-weighting filter.

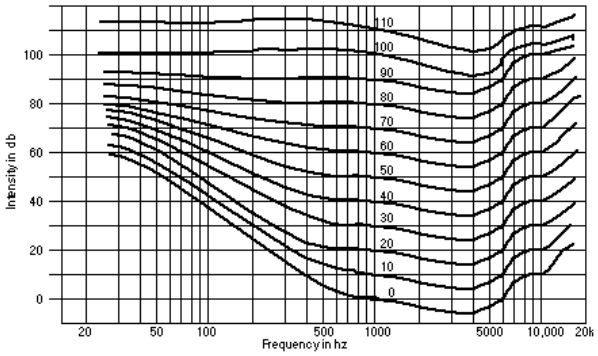


Figure 7 – Equal loudness contours

Provision for the hearing aid and perceptual signal filtering characteristics thus seems appropriate but is lacking in the near field RF assessment process for the M-category rating. This deficiency causes the M-category rating of 2 different service provider's handsets to be the same, yet the amount of interference experienced by a user of both will be substantially different. In contrast a filtering provision is included in the audio band magnetic field interference methodology to determine the C63.19 T-category rating for a handset. In particular an A-weighted filter is prescribed in clause 6.3.4.3 presumably because its design is intended to approximate an inverse loudness curve. Its characteristic is not included in the standard but is shown in Figure 8. A possible remedy of this audio spectrum inequity between the M-category and the T-category rating is to include A-weighting in the probe modulation factor measurement of Annex C.3.1. Another would be inclusion of such a filter in the RF field measurement probes.

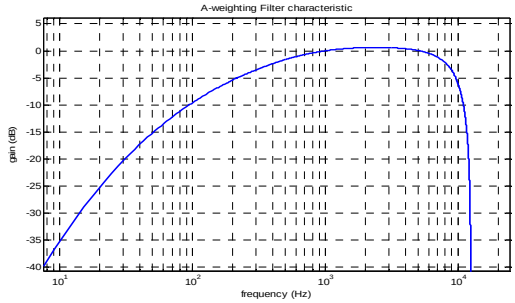


Figure 8 – Transfer characteristic of an approximated A-Weighting Filter

Figures 9 and 10 graphically compare the impact of an approximated A-weighting pass band filter on the spectrums shown in Figures 5 and 6. Numerically the impact is a reduction of 2.45 dB for GSM and 5.88 dB for iDEN; i.e., 46% of the GSM and 75% of the iDEN induced signal power lies outside this A-weighting filter (i.e. – audible) pass band. This impact would be similarly observed with other transmission envelopes so that a relative normalization factor could be readily determined for any arbitrary protocol as new technologies emerge.

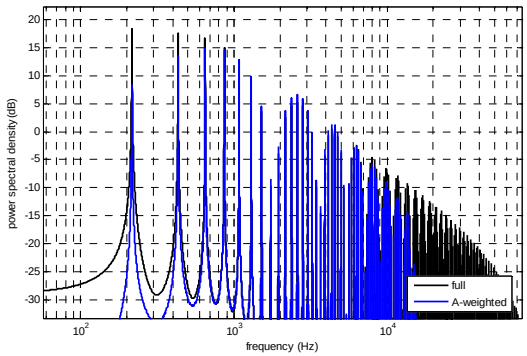


Figure 9 – A-weighting filtered GSM envelope spectrum

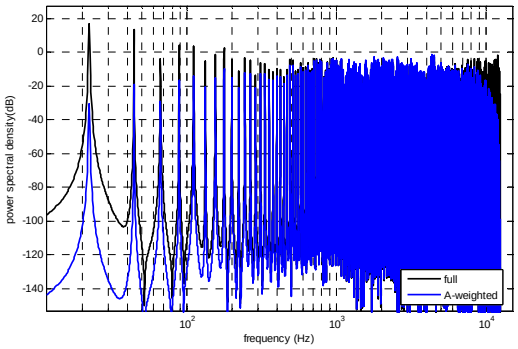


Figure 10 – A-weighting filtered iDEN envelope spectrum

Conclusions

- Hearing aids respond similarly to all wireless device power transmission envelopes and produce a signal that resembles the wireless device's power envelope.
- Wireless device induced hearing aid output interference signal strength is independent of the handset carrier and modulation frequency.
- A second harmonic component is induced of any modulation frequency leading to a distorted rendition of the handset power envelope.
- Much if not most of the induced audio interference signal will be inaudible when hearing aid and perceptual filtering is considered.
- Hearing aid and user perceptual filtering provisions need be incorporated into C63.19 to more accurately assess different modulation protocols.
- Additional provisions are needed to consider temporal characteristics of pulsed transmissions.